SCIENCE

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INTERNATIONAL CHEMISTRY[1]

SCIENTISTS have always been internationally minded. Roger Bacon spent many years in Paris. Copernicus, a native of Poland, lived in several Italian cities. Robert Boyle's winter in Florence appears to have given him his initial interest in science. In the last century, as the result of Liebig's initiative, students from all countries migrated to the chemical laboratories of Germany. In times of peace, at least, seekers for truth have paid little heed to political boundaries but have gone to sit at the feet of the masters, wherever they might happen to be. Moreover, in earlier times the savants of different countries were eager to meet and to hear from one another's lips the descriptions of new discoveries. The Royal Society of London, which was founded in 1660 at the suggestion of a German residing in that city, from the beginning adopted a policy of hospitality to all nations. One of its first fellows was a foreigner, another was the first secretary, and the foreign correspondence of the society led to its well-known journal, the *Philosophical Transactions.*

Time has brought changes. None but the students in backward nations need travel abroad to receive good scientific instruction. A multitude of books and periodicals bring us far more information than any one person has time to read. Strong national organizations have sprung up for science in general, for individual sciences, for specialties in each science. Of these, chemistry has its full share. To-day we are seeking in international intercourse not so much news and instruction, although that still has its place, as some effective means of coordination. It is as if we had built separately, with constant interchange of plans, important scattered units, which still need to be tied together into a common structure.

Briefly, what can international organizations hope to accomplish? It seems to me that their possibilities for good lie chiefly in two directions: first, carrying out projects which smaller organizations can not undertake successfully; and second, promoting a great number of personal contacts between individuals of different countries.

Permit me to sketch for you the main developments in international chemistry in the last forty years. In 1889 an International Congress of Chemistry was held at Paris in connection with the exposition of that

[1] Presented before the Cincinnati Section of the American Chemical Society on March 13, 1929.

year. Three years later, as an outcome of this congress, thirty-four chemists from nine nations met in the Geneva Congress on organic nomenclature. It is interesting to note that but one chemist, Ira Remsen, was appointed from the United States and he could not go. The Geneva Congress adopted a system of names many of which, as methanol, butanone, cyclohexane, are in use to-day.

The series of International Congresses of Applied Chemistry which dated from this period and which were held every three years continued until interrupted by the World War. The eighth and last one took place in New York in 1912; very probably some in this audience attended it. These congresses were brilliant affairs, with many speeches, section meetings and dinners, and the papers read at each one, on all branches of applied chemistry, were published in several thick volumes.

Meanwhile, there was one matter in which the need for uniformity was very strongly felt—the values of the atomic weights of the elements. In 1900 a large international committee on this subject was organized, composed of more than fifty members representing various organizations. These delegated the task of digesting the data and constructing a table of international atomic weights to a committee of four; one from England, one from France, one from Germany and one from the United States. F. W. Clarke was the American member. The table authorized by them was published once a year in the journals and made it possible for chemists the world over to use the same figures in their calculations. The war interrupted this work also, and it has not so far been resumed, although national tables are published.

But the work on atomic weights was very limited, and the triennial congresses were on applied chemistry only. There was a demand for some form of organization that would federate the various chemical societies of the world and enable them to take concerted action on certain matters of common interest. Wilhelm Ostwald, of Germany, and Albin Haller, of France, in conversations together, conceived the idea of an International Association of Chemical Societies. Haller presented the matter before the council of the French Chemical Society, which approved it and submitted it to the German and English societies. The reply was favorable. A little group of delegates from the three societies met on April 25 and 26, 1911, in Paris, founded the association and constituted themselves the first council. Ostwald was elected president. Sir William Ramsay and P. F. Frankland were the British delegates. The object of the association was declared to be to form a bond between the chemical societies of the world in order to deal with questions having a general and international interest for chemistry. The council decided to organize international committees on three subjects: inorganic nomenclature, organic nomenclature and the unification of the symbols for physical constants. There was also talk of the promotion of a universal language, the unification of the sizes of book and journal pages and the publication of a chemical lexicon more complete than any now existing. At the second meeting, held in Berlin in 1912, the chemical societies of Switzerland, the United States, Russia, the Netherlands, Norway and Denmark were represented on the council. The American Chemical Society was represented by W. A. Noyes. The third and last meeting was held in Brussels in 1913. At that time seventeen societies, from fourteen different countries, were members, representing nearly 20,000 chemists. It was announced that Ernest Solvay, the well-known Belgian manufacturer, had made a gift to the association of 250,000 francs, and that he proposed to found an international institute of chemistry, in the government and revenues of which the association would be the principal participant.

The future looked bright. Then came the war, and the new organization, like the triennial congresses, died a violent death. What destruction the world conflict wrought on international science we can realize better in considering the many bonds that chemists alone had established among themselves, the scattered strands of which have not yet been completely reunited.

As throwing light on postwar developments, it may be well for us to take a glance at the nature of the International Association and at what it accomplished during its brief life. Its meetings were not congresses; they were select gatherings. The council might be represented by three delegates only from each country, chosen from one society. The other societies could be represented by one non-voting delegate each. The permanent seat was to be at Brussels, but meetings were to be held in various countries. As to accomplishments, several projects were started but the only one actually realized seems to have been the adoption of a list of international physicochemical symbols. These were published in the report of the meeting of 1913 and in some of the journals, and have found use since—for example, in International Critical Tables.

For the next four years chemists were too busily engaged in attack and defense to think of international cooperation except among allies and through the machinery of their governments for war purposes. But at the very close of the conflict the germ of a new international chemistry came into existence. In October, 1918, delegates from the scientific academies of the allied nations met in London to organize

an International Research Council, the purpose of which was to coordinate international activities in different branches of science and to promote the creation of international associations or unions in the separate sciences where these might seem useful. In November, in London, a reception was given to President Kestner, of the French Society of Industrial Chemistry, at which the idea of an international chemical union among the allied countries was discussed. When, in April of the following year, President Louis, of the Society of Chemical Industry, returned the French visit, a conference was held in Paris, attended by chemists from Belgium, France, Great Britain, Italy and the United States. The last-named country had eleven representatives. A second conference was held in London in July. It seemed natural that the new confederation should take its place in the scheme provided by the International Research Council. Statutes were adopted and officers elected. Charles Moureu, French academician, became president, and Jean Gérard, the efficient secretary of the French Society of Industrial Chemistry, was made general secretary. The seat of the confederation was fixed provisionally as Paris. The scene now changes to Brussels. Haller, president of the old Association of Chemical Societies, having received from his council a referendum vote, declared the association formally dissolved. In its place the International Union of Pure and Applied Chemistry was constituted and Moureu succeeded to Haller's place. The statutes of the union were approved by the International Research Council in the same city six days later.

The union is now nearly nine years old. It held its first meeting in Rome in 1920, and has since met once a year, in the following places: Brussels, Lyons, Cambridge, Copenhagen, Bucarest, Washington, Warsaw and The Hague. At the Hague meeting seventeen nations sent delegations. Bulgaria, first of the nations siding with Germany in the war, was admitted, and invited representatives from Germany, Austria and Soviet Russia were present. The union which originated among the allies is now well on the road toward its goal of complete international representation.

In organization the union differs somewhat from the old association. It requires that a nation, in order to be represented, must first establish a connection among its chemical organizations, either by forming a federation of these or by creating a national council. In the case of the United States, this coordinating agency is the National Research Council, acting through its Division of Chemistry and Chemical Technology. This division appoints the American delegates and councilors. The general assembly of the union is composed of delegations (of not exceeding fifteen members) from each country. The council, which is the actual governing body, is made up of from one to six members from each nation, based on population. The sums payable by the different countries for the support of the union are also graduated according to population. The eight vice-presidents are chosen by the council from its own number, and the president from the vice-presidents. These officers, together with past presidents and the general secretary, constitute what is known as the bureau, to which the executive power of the council is delegated. The office of the union is called the International Office of Chemistry;[2] it is the seat of administration of the union and remains, but still provisionally, in Paris. It functions under direction of the council and is in charge of the secretary.

Like the old association, the International Union seeks to accomplish results largely through different commissions on which the various nations are represented. These commissions are so large, however, that they usually delegate the actual constructive work to small *comités de travail,* or working committees.

Some of the subjects that have been entrusted to commissions are: chemical elements, inorganic nomenclature, organic nomenclature, biochemical nomenclature, chemical literature, chemical standards, analytical reagents, tables of constants, fuels, ceramic products, foods, scientific and industrial property rights and industrial hygiene.

The union is giving modest financial support to two enterprises. The first of these is the "Annual Tables of Constants and Numerical Data, Chemical, Physical, Biological and Technological," which were originated before the war under the auspices of an international committee established by the Sixth Congress of Applied Chemistry, and which are edited by Charles Marie, in Paris. These tables should not be confused with International Critical Tables, as they cover the literature year by year and will serve as annual supplements to the Critical Tables. The other enterprise is the "International Bureau of Physicochemical Standards," conducted under the direction of Jean Timmermans, at Brussels. This bureau has to do with the preparation of standards for thermochemical measurement, refractometry, etc., and the critical study of different constants for various substances. Both these enterprises are being conducted with great ability and are proving their usefulness.

The Commission on Chemical Elements has been authorized to resume the publication of international tables of atomic weights, discontinued during the war.

[2] But see foot-note 3.

The International Union has now been a "going concern" long enough to make possible an appraisal of its value. As an institution it has met with some rather severe criticism. One may very easily note from its organization that the union resembles the old association in being a select body, composed of a limited number of delegates. Attendance upon its meetings has never, I think, even including wives and other guests, reached two hundred. Moreover, the same delegates in many cases attend year after year. Such a structure should and does conduce to efficiency in transacting business, and is certainly delightful for the fortunate persons who thus hold reunions and are entertained together, but it is liable to lose the support and interest of chemists in general. A small deliberative body is no doubt a necessity, but there is also in evidence a decided demand for true international chemical conventions or congresses. The union talked of such a congress at each meeting but did not take any action about it until last year. Such a congress now seems assured for the year 1932, organized at Madrid by the chemists of Spain under the auspices of the union.

Another criticism is that the commissions are not functioning properly. This must have been evident to any one attending the meetings. The commissions are composed of one or more representatives from each of several countries. The chances are excellent that a large majority will be unable to attend the meeting. The president must then appoint substitutes from among the chemists who happen to be present. Most of these are not familiar with the situation. To such a group just about two possibilities present themselves: either to indorse the report of the working committee without change, in which case the commission meeting becomes a rubber stamp; or else to lay themselves open to the danger of being swayed by a special plea or by an argument that has occurred to some one on the spur of the moment. It must be apparent that the real work of the commissions is done by the working committees; if these were to report to their commissions by mail, and secure, first, criticisms and then an approving vote, the procedure would be improved. This is now being done in at least one case.

The subsidiary national committees must also do their part if there is to be satisfactory accomplishment. As one prominent member of the union writes:

> At present there is no effective team work. Each country works alone, or at least with only one or two others, and then when the meetings occur there is no common ground for anything. The question is, How can work be done in the intervals between the meetings, and how can the most effectual cooperation in each country be assured?

The work of the commissions has, in fact, been uneven. Some have considerable accomplishments to which they can point; others very little. The union has been criticized also for not having more scientific papers on its programs. This is to be remedied in the future.

The meeting held last year at The Hague was the liveliest of its history, and some housecleaning was done. President Cohen, concluding his three years' term, pointed out again what seemed to him the weak points of the organization which, as he phrased it, were: "We meet too often, and we make too many reports." Revisions in the statutes were adopted. Hereafter the union will meet only once in two years. The next meeting will be at Liége in 1930, and the following one will be the congress already referred to at Madrid in 1932. The work of the commissions was checked up more rigorously than heretofore. Some were discontinued and others were instructed to reorganize their work. The decisions of the council on international nomenclature, symbols, standards, etc., are to be provisional for one year and the final vote is to be by correspondence.

Those who have attended meetings of the union are not overoptimistic as to what the international body can accomplish in a formal way. They see that international accord is needed on certain matters such as atomic weights, nomenclature, standards, etc., but they also have had some experience of the difficulties that are in the way of achieving positive results. On the whole, however, the effort seems so worth while that many are inclined to persevere. International machinery and cooperation are still in a formative stage and can be greatly improved. Our own chemical division of the National Research Council has recently appointed a committee of four to advise it on ways and means of making American cooperation in the union more effective.

Whatever may be the formal contributions to international accord accomplished by the union, there is no doubt whatever of its indirect benefits in bringing together in social intimacy the chemists of countries from all over the world. One gets a new conception of the universality of our science, he finds friends with common interests from the most diverse countries, he goes home and forever after reads their articles with a new interest, and feels that he can correspond with them on a new basis. It is well to know that these benefits are not to be restricted to the few but are again to be extended, as in the former congresses, to all the chemists who can manage to attend.

The present movement is only in its infancy. Beyond the little projects on which progress has already been made there are dreams for the future. One of

these is the international coordination and distribution of literature. At the Copenhagen meeting of the union in 1924 a Commission of Documentation was created. Outlines have been made and meetings held from time to time. It is now proposed by the commission that a conference of experts be held in Paris to study the question. This conference will have a large and difficult problem to attack. We all realize how large our literature has become and how rapidly it is increasing. We also see the value that has come from establishing, under international auspices, the Annual Tables in France and the Critical Tables in America, and from the encouragement of such series of monographs as those of the American Chemical Society. Indeed, it would seem that at present the most profitable field of international direction or agreement lies in assigning specific tasks to specific countries to supervise and carry out with the assistance of the chemists of other nations. But the dreams do not stop there. Ostwald visioned an international institute of chemistry which should comprise a universal chemical library, indexes of chemical substances, of chemical theories, of chemical history and of individual chemists, an international abstracting bureau, the editing of handbooks and minor works of all sorts, and much more besides. Duplication was to be done away with, unnecessary expense was to be saved, and chemists everywhere were to be provided with the literature that each most needs. We are still far from such a goal and must arrive at it—if it should ever prove practicable in its entirety—with some caution. Too much centralization might conceivably do damage to the enterprises already built up with so much pains and might restrict individual and national initiative. The advantages of centralization can be overemphasized. Several years ago there was an agitation for a centralization of the activities of our own society in New York City. It came to naught because sufficient benefit could not be shown. The office of *Industrial and Engineering Chemistry* is conveniently situated at the seat of government and near the center of chemical industry; *Chemical Abstracts*, on the other hand, finds an advantage in being nearer to the center of the country, where manuscript and proof can move to and from abstractors and editors in the shortest possible time. If an international central bureau were to conduct an abstract journal it would find it difficult to please all its customers, some of whom would want first of all a complete index to the literature and others full abstracts, in some cases with drawings, of the more important articles or patents in their field. Such a journal would find it difficult to maintain a truly international character; abstractors in far-off countries such as America and Japan would cause unwarranted delays, and in the interest of prompt service it might be found necessary eventually to confine the editorial activities to one section of Europe. The distribution of such a journal would also have drawbacks. To furnish an American reader with the abstract of an American article would entail a double delay; and if, to avoid this, the journal were edited and published in two places, duplicate staffs would be needed.[3]

In all that we have said previously the language obstacle has been implicit but scarcely mentioned. The languages recognized by the International Union have been English, French and Italian, to which German has recently been added. These are the four chief languages of chemistry. The Dutch do not get much recognition for their own language because they are excellent linguists and seem to be able to speak all the others. At present all motions, reports, etc., are required to be in French, but there is considerable agitation to place English in the same category and to state all important matters in both languages.

To many of you the notion of an artificial language for universal use as an auxiliary to one's native tongue no doubt seems Utopian, yet I can not resist contrasting in my own mind sessions of the council of the union, in which English had to be translated into French and French into English, sometimes with consequent misunderstandings followed by translations, with the sessions of the International Esperanto Association of Scientists. In the latter gathering scientists of equally diverse countries indulged in lively oratory and spirited debate without a single question, translation or misunderstanding because each one had familiarized himself with one easy common tongue. No nation had a decisive advantage, as is the case when any current natural language is used.

The number of artificial languages that have been invented is legion, but most of them have few adherents. Ostwald was an enthusiast for Ido, an offspring of Esperanto. I have no special plea to make for Esperanto, but confess to a prejudice in its favor on

[3] Since the delivery of the address the author has received a letter, dated March 1, 1929, from Secretary Gérard, which states that it is not intended that the International Office of Chemistry should itself undertake chemical publications, but that it should study the international organization of literature, establish cooperation between the sources of literature production in the different countries, facilitate exchanges and loans of chemical documents between government bodies, universities, learned societies, libraries, etc., and aid in working for the unification of methods. However, M. Gérard calls attention to the fact that in the new regulations of the union there is no mention of the International Office (which has now been constituted independently by diplomatic convention). He also states that the Commission of Documentation has been discontinued.

account of the great lead it has over its competitors. A little conversation has been going the rounds which runs about as follows:

"What is Esperanto?"

"Why, don't you know? It's the universal language."

"Really! Who speaks it?"

"Oh, nobody."

Now, relatively speaking, this is true, but in an absolute sense it is not. It is estimated that about a million people speak Esperanto. A considerable number of European stations broadcast regularly in it. About one hundred periodicals are published in it. Esperanto is officially recognized for telegrams. Chemical articles are being published in it. It is used as a medium of correspondence. Just the other day a professor in the University of Ljubljana, Yugoslavia, wrote to me in Esperanto, asking if I were the inventor of the Patterson X-ray screens, of which he wished samples. I was able to refer him to the Patterson Screen Company of Towanda, Pennsylvania.

Esperanto has its defects and will probably ultimately be improved by international agreement. The International Auxiliary Language Association of New York City is studying the whole question. Its officers report increasing interest in an auxiliary language among scientists, business men and other classes. Why not? Chinese speaking different dialects use Mandarin as a common language. Educated Europeans formerly used Latin in a similar way, but its use was discontinued because it was too inflexible to be adapted to modern speech. It is not at all improbable that in the future our children in all countries may learn an auxiliary language in the schools and that a great many chemical articles, abstracts and books may regularly be published in the same common tongue. If that should come to pass, a great barrier will have been removed.

International intercourse and cooperation in chemistry must increase. If the union proves not to be a fit instrument it will be discarded, but something else will rise in its place. Such interrelations are growing steadily in politics, in commerce, in industry, and it is inevitable that they should do so in science as well. The task is a delicate one, abounding in difficulties, and our technique for handling it is still very faulty. Let us have large patience in working it out.

Austin M. Patterson

Antioch College

THE FORMAL OPENING OF DARWIN'S HOUSE AT DOWN, JUNE 7, 1929

American journals from time to time have reported the purchase and restoration of Darwin's home at Down and prior to the coming opening on June 7 it will be interesting to readers of Science to review part of the statement issued by the British Association:

The History of Down[1] House

It may not be amiss to recount some of the circumstances which led up to the appeal for the preservation of Darwin's home. Some years before his death the late Sir Arthur Shipley, master of Christ's College, Cambridge, where Darwin was an undergraduate, wrote to a member of the British Association as follows: "It seems to me that Down House ought to be a national possession. Do you know of any means by which this can be brought about?" On the eve of the Leeds meeting of the British Association on August 31, 1927, the council of the association considered this matter and empowered the then president (Sir Arthur Keith) to make a public appeal at the close of his presidential address to the assembled association. An urgent S.O.S. was sent out with the happy result which all now know. It was with as much surprise as satisfaction that Sir Arthur Keith learned that the man who answered the call was a fellow of his own college. Indeed, he knew Mr. Buckston Browne as a generous benefactor to that college and to the Harveian Society, but was unaware of his love for Darwin and for Down. It was later that he learned that Darwin's friend Huxley had long ago exerted an abiding influence on the donor of Down.

Darwin's Association with Down House

Darwin was born at Shrewsbury, February 12, 1809. Down House was purchased for him by his father, Dr. Darwin, and he took up his residence there on September 14, 1842. Darwin was then in his thirty-fourth year; three years previously he had married his cousin, Emma Wedgewood. His two eldest children, William and Anne, were born in London; the third, Mary, was born and died just after arrival at Down. Then followed in 1843 Henrietta, who became Mrs. Litchfield; in 1845 George, who became Sir George Darwin, F.R.S., and whose son, Professor Charles Darwin, F.R.S., succeeded to the ownership of Down and is the fifth of a succession of father and son who have been elected fellows of the Royal Society—a unique record; in 1847 Elizabeth was born; in the following year Francis, who became Sir Francis Darwin, F.R.S.—a distinguished botanist and president of the British Association. His son, Bernard Darwin, is known to all as an exponent as well as an authority on golf. Leonard followed in 1850—Major Leonard Darwin, scientist, philanthropist and the founder and still active supporter of the Eugenics Society. Then came Horace, now Sir Horace Darwin, F.R.S., happily still alive. And last number 10, Charles Waring Darwin, who died in childhood. Down was thus the home of a large and happy family, perhaps the most gifted family ever born in England. There the great naturalist died on April 19, 1882, in his seventy-fourth year. He worked continuously at Down for almost forty years.

[1] On the ordinance survey maps the spelling is *Downe*, but as Darwin always wrote *Down* without an "e" the latter spelling has been adopted.

In that period he made his first draft of the "Origin of Species" (1842), he wrote his researches on the "Zoology of the Beagle," on "Coral Reefs," and prepared a new edition of a "Naturalist's Voyage." Before he settled down to work at "Barnacles," to which he gave seven years (1847–54), he prepared his papers on "Volcanic Islands" and on the "Geology of South America." Preparations for the "Origin of Species," which did not receive its final form until 1858–59, went on continuously from 1842 onwards. Then followed his inquiries into "Fertilization of Orchids" (1862), "Variations of Animals and Plants under Domestication" (1868), "Descent of Man" (1871), the "Expression of the Emotions" (1872), "Movements and Habits of Climbing Plants" (1875); "Insectivorous Plants" appeared in the same year; "Cross and Self Fertilization" in 1876, and his last work of all, one which was begun soon after he settled at Down, "The Formation of Vegetable Mould through the Action of Worms." No single home in the world can show such a record. Truly from Down Charles Darwin shook the world and gave human thought an impress which will endure for all time. Down is a priceless heirloom not only for England but for the civilized world. One of the greatest men of all time lived there.

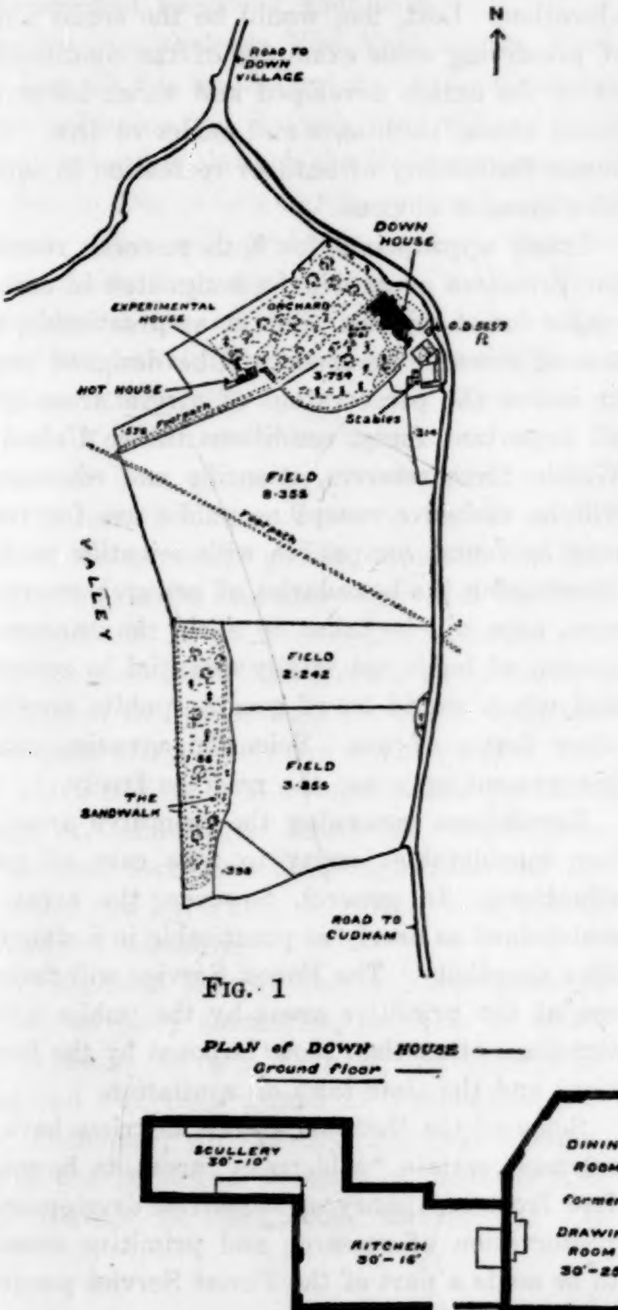

FIG. 1

The two accompanying plans, the data for which were obtained through the kindness of Major Leonard Darwin, will give a precise idea of the extent of the property and of the plan of Darwin's home. Fig. 1 shows the arrangement and extent of the grounds; the figures indicate the acreage of each part. Down House is seen to be situated at 565.7 feet O.D. The plantation with the sand walk round it—Darwin's "thinking path"—with the dry chalk valley beyond, are depicted; so, too, are the orchard, gardens and hot-houses. In Fig. 2 is given a plan of the ground floor of Down House, the dimensions of each room being indicated in feet. It will be seen to be a commodious house, and remains just as Darwin lived in it. He added a new wing—that which includes the "New Study" and the "New Drawing Room."

The present writer has been actively interested in this matter for several years past and recently has been in correspondence with the donor, Mr. G. Buckston Browne, who writes under date of April 3, 1929:

Thank you for your kind letter of March 19. This is not a reply, merely an acknowledgement. The repair of "Down," Darwin's old home, goes on apace. The house is to be opened to visitors on June 7. I am having a fire-proof show case put into the second study, where what you may be good enough to send, will be safely housed.

Mr. Ouless is too old to paint a copy of his original portrait.

Mr. C. L. Hartwell, R.A., has made a fine bust of Darwin—after a careful study of all the portraits and sculpture I could show him. This bust will be exhibited

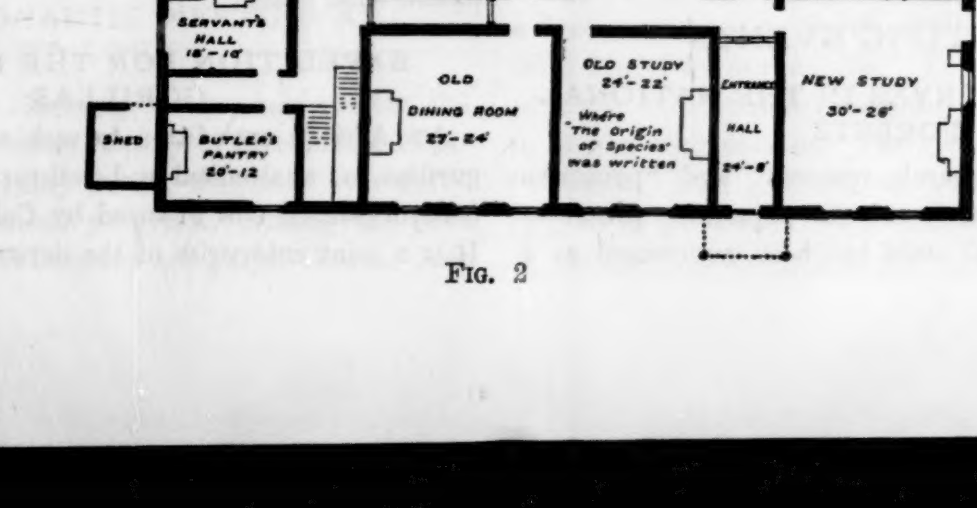

FIG. 2

in the approaching Royal Academy exhibition (May 1). The price in the catalogue will be £300. I wish someone would present it to Down House. The Japanese Government wants a copy for Tokio.

In order to advance the most interesting movement to restore to Down House memorabilia of Darwin, the following committee of members of the American Association has been appointed to cooperate with the British Association:

Dr. Andrey Avinoff
Dr. William Beebe
Dr. Nathaniel Lord Britton
Dr. Frank Michler Chapman
Dr. E. G. Conklin
Dr. Joseph Grinnell
Dr. Henry Fairfield Osborn
Dr. George Howard Parker
Dr. Frank Alexander Wetmore
Dr. William M. Wheeler

On May 8 the following cable was received from the British Association:

Professor Osborn, American Museum of Natural History, N. Y.

Formal opening Darwin's house June seventh. Council delighted if you could name representative American Association able attend giving postal address for invitation.

Howarth, *Secretary* British Association

In response to this cable a representative, or representatives, of the American Association will be selected. The return of Down House as a British national monument is an event in which biologists in all parts of the world will rejoice. Gradually much of the original furniture of the house will be returned and already many very interesting memorabilia in the form of original Darwin letters, original editions of Darwin's works, and volumes from Darwin's own library have found their way back to Down.

When the present writer visited Down in 1926, accompanied by Major Leonard Darwin, and stood on the spot where the immortal "Origin of Species" was written, he joined Sir Arthur Shipley, Sir Arthur Keith and several others in the resolve that this classic center of biology should be returned to its original purpose.

Henry Fairfield Osborn
American Museum of Natural History

SCIENTIFIC EVENTS

RESEARCH RESERVES IN THE NATIONAL FORESTS

Creation of "research reserves" and "primitive areas" in the national forests for permanent preservation in their natural state has been announced as a policy of the U. S. Forest Service. Research reserves will be set apart for scientific and educational purposes and primitive areas will be maintained to offer to the nature lover and student of history a representation of conditions typical of the pioneer period.

"With the exception of the national parks and Indian reservations," the Forest Service says, "the national forests include the only considerable areas of land within the United States in which the original or virgin conditions have not been much modified by human action. Each year invasion threatens some such areas.

"Reduction of all wild areas to a common level would constitute an irreparable loss to science and education. Lost, too, would be the social advantage of preserving some examples of the conditions under which the nation developed and which influenced national ideals, traditions and modes of life. The economic desirability of outdoor recreation in such primitive areas is obvious."

Tracts appropriate for both research reserves and for primitive areas will be designated in each of the major forest regions. So far as practicable, the system of research reserves will be designed eventually to insure the preservation of virgin areas typifying all important forest conditions in the United States. Within these reserves, scientific and educational use will be exclusive except as public use for recreation may be found compatible with scientific studies. In determining the boundaries of research reserves, however, care will be taken to avoid the unnecessary inclusion of lands not vitally essential to scientific use, and which would be of greater public service under other forms of use. Scientific agencies outside the government may use the reserves freely.

Regulations governing the primitive areas will allow considerable leeway to take care of particular situations. In general, however, the areas will be maintained as nearly as practicable in a state of primitive simplicity. The Forest Service will favor liberal use of the primitive areas by the public without restrictions other than those imposed by the fire regulations and the state laws on sanitation.

Some of the National Forest districts have already set aside certain "wilderness" areas, to be maintained free from occupancy or industrial development. The preservation of research and primitive areas is now to be made a part of the Forest Service program on a nation-wide basis.

EXPEDITION FOR THE STUDY OF GORILLAS

An African expedition to seek adult specimens of gorillas for anatomical and anthropological study has been organized and financed by Columbia University. It is a joint enterprise of the department of anatomy

of the College of Physicians and Surgeons of Columbia and of the department of comparative anatomy of the American Museum of Natural History.

Henry C. Raven, associate curator of the American Museum of Natural History, who has made previous trips to Africa, will lead the party, which will include Dr. William K. Gregory, professor of vertebrate paleontology, Columbia, and curator of the department of comparative and human anatomy of the American Museum of Natural History; Dr. J. H. McGregor, professor of zoology, Columbia, and research associate in human anatomy at the museum, and Dr. E. T. Engle, associate professor of anatomy, College of Physicians and Surgeons, Columbia.

The party plans to leave New York on the *Aquitania* on May 29, for Southampton. After obtaining equipment in London and Brussels, they will sail from Marseilles, proceeding through the Mediterranean and the Red Sea to Dar-es-Salaam, the port of entry in East Africa. They will probably go from there to Kigoma on Lake Tanganyika, thence to the Kivu Plateau to remain two or three months, after which the journey will be continued to one of the tributaries of the Congo River, and down to the West Coast. They expect to return early next year.

Sanction has been given by the Belgian government for the scientists to endeavor to obtain several specimens of the mountain gorilla, found in the Belgian Congo, outside the sanctuary known as the Park d'Albert Nationale. In the French Congo, on the west coast, with the sanction of the French government, a few specimens of the lowland gorilla will be collected.

Arrangements of the party are in charge of a committee of which Dudley J. Morton, associate professor of anatomy at Columbia, is chairman. Other members are the four members of the expedition and Dr. S. R. Detwiler and Dr. Philip E. Smith, both Columbia professors of anatomy.

President Nicholas Murray Butler is chairman ex officio of the advisory committee, members of which are: Dr. William Darrach, dean of the College of Physicians and Surgeons; Frank D. Fackenthal, secretary of Columbia; Dr. Henry Fairfield Osborn, president of the American Museum of Natural History, and George H. Sherwood, director of the museum.

THE AERONAUTIC MEETING AT ST. LOUIS

The Aeronautic Meeting to be held under the auspices of the American Society of Mechanical Engineers in St. Louis, May 27–30, will have over forty papers on the technical program. Among the presiding officers for the sessions are Major-General Jas. E. Fechet, Chief U. S. Army Air Corps; Brigadier-General W. E. Gilmore, Commander, Wright Field, and Chief of Material Division, U. S. Army Air Corps; Dr. Karl Arnstein, vice-president, Goodyear-Zeppelin Corporation; Chas. L. Lawrance, president, Wright Aeronautical Corporation; Hon. Wm. P. MacCracken, assistant secretary, Department of Commerce; William Mayo, chief engineer, Ford Motor Co.; Dr. Geo. K. Burgess, director U. S. Bureau of Standards; Captain Emory S. Land, vice-president, Daniel Guggenheim Fund for Promotion of Aeronautics; Colonel V. E. Clark, former chief aeronautical engineer, U. S. Army; Major Thomas Morgan, president, Sperry Gyroscope Co.; Porter Adams, former president, National Aeronautic Association, and Professor Alexander Klemin, director, Daniel Guggenheim School of Aeronautics, New York University. Among others present will be Sir Hubert Wilkins, who has just returned from the South Pole, Amelia Earhart, transatlantic flier, Orville Wright and Elmer A. Sperry.

Many exhibits are being arranged. In the lobby of the Jefferson Hotel there will be a replica of the "Spirit of St. Louis," anti-aircraft gun mounts, parachutes, balloon baskets, a mosaic air picture of St. Louis comprising about 1,000 exposures. The St. Louis Public Library and all its branches will have special exhibits of airplane models, posters and aerial maps, aviation books, etc.

A novel airplane exhibit will be held at Lambert, St. Louis Flying Field. One hundred and twenty-five American airplane manufacturers have been invited to fly to St. Louis and group their planes for inspection and demonstration to the public of the extent of this industry in America.

On Tuesday, May 28, there will be a special airship program at Scott Field, near St. Louis, the famous Army Airship Field. The banquet on May 29 will have Dr. Stefansson, Arctic explorer, and Sir Hubert Wilkins as the principal speakers. At the banquet will be bestowed the twelve gifts to those whose contributions, in the eyes of the judges, have been exceptionally valuable.

The Garner Cup Air Races will run their finals on May 30 at the Parks Airport, which is to be the final event of the program.

The St. Louis Section of the society has established a fund to provide a "Spirit of St. Louis" A. S. M. E. Gold Medal in Aeronautics. The trust was accepted with the understanding that the first award be made to Daniel Guggenheim. The medal was designed by Professor Victor S. Holm, of Washington University. It is to be presented in St. Louis on the anniversary of Colonel Lindbergh's flight to France.

THE TWENTY-FIFTH ANNIVERSARY OF THE CARNEGIE INSTITUTION OF WASHINGTON

ON Friday, May 31, at Cold Spring Harbor, Long Island, the Department of Genetics of the Carnegie Institution of Washington will be "at home" to invited guests in celebration of the twenty-fifth anniversary of the organization of the department and of the beginning of the active work of research for which Carnegie Institution was founded.

An exhibition has been arranged to illustrate the current work of the investigators in the field of genetics and in related fields. The exhibits have been organized to show what has been accomplished by the department in answering the question: "What is it that makes differences and likenesses among living things?"

A program of exercises has been arranged which includes brief addresses by members of the board of trustees of Carnegie Institution, by Dr. E. G. Conklin, professor of biology at Princeton University, and by Dr. John C. Merriam, president of the Carnegie Institution.

On Saturday and Sunday, June 1 and 2, between the hours of 10 A. M. and 1 P. M. and 3 P. M. and 6 P. M., the exhibition will be open to the public generally. The investigators and their assistants will describe the exhibits and explain their significance.

Similarly, on the west coast, probably during the latter part of August, will occur a second celebration of the twenty-fifth anniversary of the inauguration of research activities by Carnegie Institution of Washington. This celebration is being organized by the Department of Terrestrial Magnetism, one of four departments of research founded in 1904 by the trustees of the institution.

The exercises and exhibition will be held in San Francisco and will relate somewhat closely to the activities of the scientific staff aboard the ship *Carnegie*, now out on a three-year cruise which will cover all oceans. The vessel, now in Pacific waters, is due to arrive in San Francisco late in July. Toward the end of August, according to present plans, she will depart. The exhibition will be held aboard the *Carnegie* shortly before she is due to sail.

It is especially appropriate that this exhibition be given on the Pacific Coast, for the initial work of the Department of Terrestrial Magnetism at sea, in observing compass variations and other magnetic and electric elements, was done in the Pacific with the chartered brigantine *Galilee*, which outfitted in San Francisco specially for the purpose.

THE NON-RESIDENT LECTURESHIP IN CHEMISTRY OF CORNELL UNIVERSITY

THE Non-resident Lectureship in Chemistry at Cornell University, established in 1926 by a gift from Mr. George Fisher Baker, enables the university to invite chemists and also those who have attained distinction in other branches of science to deliver lectures before the department of chemistry and to conduct a weekly colloquium. A private research laboratory is placed at the disposal of the lecturer and a few advanced students are usually afforded the privilege of carrying on investigational work under his direction.

The first lecturer under this foundation was Professor Ernst Cohen, of the University of Utrecht, Holland, whose lectures dealt with "Physico-Chemical Metamorphosis and Some Problems in Piezo-Chemistry." Those that followed Professor Cohen were:

First Term, 1926–1927

Professor Fritz Paneth, an Austrian by birth, who is now professor in the University of Berlin, Germany, "Radio Elements as Indicators and Other Selected Topics in Inorganic Chemistry."

Second Term, 1926–1927

Professor Alexander V. Hill, Foulerton Research Professor of the Royal Society of London, England, "Muscular Movement in Man: The Factors Governing Speed and Recovery from Fatigue."

First Term, 1927–1928

Professor Paul Walden, University of Rostock, Germany, "Salts, Acids and Bases: Electrolytes: Stereo-Chemistry."

Second Term, 1927–1928

Professor George Barger, University of Edinburgh, Scotland, "Some Applications of Organic Chemistry to Biology and Medicine."

First Term, 1928–1929

Professor Hans Pringsheim, University of Berlin, Germany, "The Chemistry of Monosaccharides and Polysaccharides."

Second Term, 1928–1929

Professor F. M. Jaeger, University of Groningen, Netherlands, "Symmetry and Optical Activity of Atomic Configurations"; "Methods and Problems in High Temperature Precision Work."

The program for the next three years is as follows:

First Term, 1929–1930

Professor G. P. Thomson, University of Aberdeen, Scotland, "Electron Waves."

Second Term, 1929–1930

Professor K. Fajans, a native of Poland, now professor of chemistry in the University of Munich, Germany, "Radio Elements and Isotopes"; "Chemical Linkage in Relation to the Structure of Atoms and Crystals and to the Optical Properties of Substances"; "Strong Electrolytes"; "Adsorption of Ions by Salt-like Compounds and Its Photochemical and Analytical Applications."

First Term, 1930–1931

Professor G. Hevesy, a native of Hungary, now professor of chemistry, University of Freiburg in Baden, Germany, "Chemical Analysis by X-rays and Its Application"; "Rare Earth Elements and Atomic Structure"; "Chemistry of Hafnium"; "Electrolytic Conduction and Diffusion in Solids"; "Separation of Isotopes."

Second Term, 1930–1931

Professor N. V. Sidgwick, Lincoln College, Oxford, England, "Molecular Structure and the Periodic Classification."

First Term, 1931–1932

Professor W. L. Bragg, University of Manchester, England.

Second Term, 1931–1932

Professor Alfred Stock, Technische Hochschule, Karlsruhe, Germany.

SCIENTIFIC NOTES AND NEWS

DR. WILLIAM WALLACE CAMPBELL, since 1901 director of the Lick Observatory and since 1923 president of the University of California, has announced his intention of resigning from the presidency of the university at the end of the next academic year.

PROFESSOR G. H. PARKER, director of the Harvard Zoological Laboratory, has been elected a corresponding member of the Biological Society of Paris.

AT a banquet given on April 19 in the Michigan Union in honor of Mortimer E. Cooley, dean emeritus of the colleges of engineering and architecture of the University of Michigan, he was presented with honorary membership in the American Society of Mechanical Engineers. The presentation was made by Dr. Alex. Dow, president of the Detroit Edison Company and past president of the society. About one hundred and fifty faculty members and friends were present.

THE Pharmaceutical Society of Great Britain has awarded the Hanbury medal "for high excellence in the prosecution or promotion of original research in the natural history and chemistry of drugs" to Dr. Henry Hurd Rusby, professor of materia medica in the College of Pharmacy of Columbia University. The award was made by a committee consisting of the president of the Linnean Society (Sir Sidney Harmer), the president of the Chemical Society (Professor J. F. Thorpe), the president of the Pharmaceutical Society (Mr. H. Skinner), the chairman of the British Pharmaceutical Conference (Mr. R. R. Bennett) and Mr. A. R. Melhuish. It is understood that Professor Rusby will go to England in October to receive the award.

DR. LUDVIG HEKTOEN, head of the department of pathology at the University of Chicago and director of the John McCormick Institute for Infectious Diseases, was decorated on May 14 with the order of St. Olaf, conferred by the king and legislature of Norway for "distinguished service in medical science." The Norwegian consul presented the decoration at a banquet in the La Salle Hotel. The speakers included Dr. Morris Fishbein, editor of the *Journal* of the American Medical Association.

THE Joseph Priestley medal of the American Chemical Society for distinguished services to chemistry will be presented to Mr. Francis P. Garvan at the meeting of the society in Minneapolis next September. Only two previous awards have been made. In 1923 the recipient was the late Ira Remsen, and in 1926 the late Edgar F. Smith.

THE Franklin Institute, Philadelphia, has announced the award of the John Price Wetherill medal to Gustave Fast, of Annapolis, in recognition of mechanical inventions and work in development of mechanical science.

THE University of Cambridge will in June confer honorary degrees on M. Paul Langevin, director of the municipal school of physics and chemistry, the University of Paris, and on Sir Frank Watson Dyson, astronomer royal.

THE Technical Institute at Stuttgart has conferred an honorary doctorate on Dr. Albert König, of the research department of the Zeiss Optical Works at Jena.

GRANTS from the van't Hoff Fund of the American Chemical Society have, according to *Industrial and Engineering Chemistry,* been awarded for the year 1929 as follows: F. Ephraim, Bern, Switzerland; B. Flaschenträger, Leipzig; H. Friese, Berlin-Steglitz; J. Kapfhammer, Leipzig; G. Nicolt, Les Verrières, Switzerland; A. von Kiss, Szeged, Hungary; F. F. Nord, Berlin; L. Orthner, Karlsruhe; O. Schmidt, Heidelberg, and F. Zetsche, Bern.

ALEXANDER G. MCADIE, Abbott Lawrence Rotch professor of meteorology at Harvard and director of the Blue Hill Observatory, was elected chairman of the Eastern Section of the Seismological Society of America at the fourth annual meeting of the society, held at Fordham University, New York.

AT the annual meeting of the section of oceanography of the American Geophysical Union, National Research Council, held on April 25, the following officers were elected to serve for the next three years: *Chairman,* Austin H. Clark, U. S. National Museum; *Vice-chairman,* Henry B. Bigelow, Harvard

University; *Secretary,* H. A. Marmer, U. S. Coast and Geodetic Survey.

Lyman Bryson, lecturer in anthropology at the California State Teachers College, has been appointed director of the San Diego Museum to succeed Dr. Edgar L. Hewett, who has been appointed director emeritus. Dr. Hewett is director of the Museum of New Mexico at Santa Fé.

Horace W. Gillett, chief of the division of metallurgy of the Bureau of Standards, has accepted the post of director of the Battelle Memorial Institute at Columbus. The institute, founded by Gordon Battelle, 2nd, and his mother, Mrs. John Gordon Battelle, in memory of Colonel John Gordon Battelle, is a research institution whose object is to promote contact between science and industry.

Dr. William Marston, formerly lecturer in psychology at Columbia University and New York University, has been appointed director of public service in the Universal Pictures Corporation for the purpose of applying psychology to every branch of the motion picture industry from selection of stories to final sales and exploitation of pictures.

Dr. Ellwood B. Spear, for the past six years chief chemist of the Thermatomic Carbon Company, Pittsburgh, Pa., has resigned from this position.

The Board of National Research Fellowships in the Biological Sciences, of which Dr. Frank R. Lillie, professor of embryology in the University of Chicago, is chairman, held its annual spring meeting on April 25 and 26 and made the following appointments for the year 1929–30: *Reappointments:* M. R. Irwin, zoology; Carlyle F. Jacobsen, psychology; D. C. Smith, zoology; Robert C. Tryon, psychology. *New appointments:* Donald Keith Adams, psychology; Lester G. Barth, zoology; C. R. Burnham, agriculture; C. S. Coon, anthropology; Everett F. Davis, botany; Albert A. Dunlap, botany; Conrad A. Elvehjem, agriculture; Chester W. Emmons, botany; Paul R. Gast, forestry; Myron Gordon, zoology; Harry Grundfest, zoology; Edwin R. Helwig, zoology; A. R. Kelly, anthropology; A. R. Lauer, psychology; Norman R. F. Maier, psychology; O. E. Nelsen, zoology.

Philip S. Smith, chief of the Alaskan Branch of the Geological Survey, left on April 3 to attend the Fourth Pan-Pacific Science Congress in Java. He went by way of Europe and the Suez Canal, and will return by one of the Pacific routes.

The *Journal* of the American Medical Society reports that Dr. Ernest W. H. Cruickshank has arrived at Halifax from India to become director of the department of physiology at Dalhousie University. Dr. Cruickshank held a similar post at Peking Union Medical College, Peking, from 1920 to 1924, and then spent eighteen months at Cambridge University, following which he was appointed director of the department of physiology and biochemistry at the Prince of Wales Medical College in Patna, India.

I. Forrest Huddleson, of East Lansing, Michigan, has been directed by the U. S. Public Health Service to proceed to Tunis, Africa, Paris and Marseilles, London, Rome, the Island of Malta, Algiers and Morocco, and such other places in Europe and northern Africa as may be necessary in connection with field investigations of undulant fever.

Dr. W. M. Mann, director of the National Zoological Park, accompanied by Mr. A. L. Harris, municipal architect, left New York on April 16 for Southampton. They will spend the next two months inspecting the zoological gardens of Europe, studying especially the reptile and batrachian houses and insectaries. The park has an appropriation of $220,000 for a reptile house, and it is desired to incorporate in the building the best features.

Neil M. Judd, curator of American archeology, in the U. S. National Museum, left Washington on May 15 for Flagstaff, Arizona, there to join Dr. A. E. Douglass, of the Steward Observatory of the University of Arizona, and Mr. Lyndon Hargrave, of the Museum of Northern Arizona at Flagstaff, on an archeological reconnaissance of central Arizona in search of ruins from which charred timbers might be recovered. It is the desire of the present expedition, under the auspices of the National Geographic Society, to obtain sections of timbers cut before 1260 A. D. and thus to bridge the single remaining gap in the "tree ring" chronology now being erected by Dr. Douglass and by means of which it is expected most pre-Spanish ruins of the Southwest can be dated. The current researches are in continuation of the society's archeological explorations at Pueblo Bonito, New Mexico, from 1920 to 1927, under direction of Mr. Judd.

Dr. Albert P. Mathews, professor of biochemistry in the University of Cincinnati, addressed the Sigma Xi Club of the University of Alabama on May 10 on "The Coagulation of the Blood."

Sir Ernest Rutherford, of the University of Cambridge, will lecture before the German Chemical Society at its approaching meeting in Berlin.

Clarence W. Balke, of the Fansteel Products, gave the address in commemoration of the birthday of the late Edgar F. Smith before the department of

chemistry of the University of Pennsylvania on May 23. His subject was "Metals of the Tungsten and Tantalum Groups."

The family of the late Henry S. Williams, formerly professor of geology and paleontology at Cornell University and founder of Sigma Xi, national honorary scientific society, has given to the university in his memory a fund of $25,000, which will be named for Professor Williams and which will be used to foster research in the field of geology. Part of the amount will be used for the purchase and maintenance of a summer camp as a place of study for selected students of the department of geology.

At the recent meeting of the American Chemical Society, President Langmuir was authorized to present the claims of chemistry to a place in New York University's Hall of Fame. He was specifically asked to suggest to Dr. Robert Underwood Johnson, who is in charge of the selection of those whose memory is thus perpetuated, that a bust of Josiah Willard Gibbs be placed in the Hall of Fame beside those of other outstanding Americans.

Dr. John Francis Cowan, professor of surgery at Stanford University, died on May 17 at the age of fifty years.

Indianapolis has been chosen for the spring meeting of the American Chemical Society, to be held in 1931, meetings for the next two years being scheduled as follows: Minneapolis, Atlanta, Cincinnati, Indianapolis. Invitations for the fall meeting of 1931 have been presented from Cleveland, Denver, Syracuse and Kansas City by the respective sections having headquarters in these cities. At the recent Columbus meeting Secretary Parsons reported that the society finds itself in the best position of its career in membership gains and totals, as well as in the variety and success of its activities. In the past year there has been a net gain in membership of more than 1,000 and the total membership on April 1 was 17,273.

The forty-second meeting of the American Astronomical Society will be held at the Dominion Observatory, Ottawa, Canada, from August 27 to 29.

The annual meeting of the American Home Economics Association will be held in Boston from July 1 to 5.

The Eta chapter of Sigma Pi Sigma, national honorary physics fraternity, was formally installed at the University of Chattanooga on May 17. Dr. J. M. Douglas, of Davidson College, a national councilor of the society, was the installing officer. Eleven charter members, including Dr. David W. Cornelius, head of the physics department, were admitted. The officers of the chapter are: *President,* Harry B. Deuberry; *Vice-president,* Reed Gardner; *Secretary,* Paul O. Farmer; *Treasurer,* Kermit Lowry. This chapter is one of a group to be installed this spring.

President C. C. Little, who retires from the presidency of the University of Michigan at the end of the academic year, has been appointed director of the Roscoe D. Jackson Laboratory for Cancer Research on Mount Desert Island, a short distance from Bar Harbor, Maine. The *Journal* of the American Medical Association recalls that in 1927 a fund was donated to the university for five years to continue research under Dr. Little's direction. It was provided, however, that in case he left the university, the beneficiary of the fund might be changed. The laboratory now being erected in Maine is a two and a half story building with nine rooms for investigators, eleven animal rooms, a histologic laboratory and a record office. The personnel which has been engaged in this work at Ann Arbor will be transferred to the new laboratory. The trustees and donors of the laboratory include Mrs. R. B. Jackson, wife of the late president of the Hudson Motor Car Company; Mr. and Mrs. Edsel Ford, Mr. and Mrs. Richard H. Webber and George B. Dorr. The fund to carry on the work amounts to $45,000 annually, and if progress warrants, at the expiration of the five-year term, the donors will provide additional support.

The entire collection of the Academy of Natural Sciences of Philadelphia relating to the archeology and ethnology of the American Indian has been sold to the Museum of the American Indian, Heye Foundation, at Broadway and 155th Street, New York City, and will be transferred there immediately. The principal part is the Clarence B. Moore collection, said to be the largest and finest known collection from the prehistoric Indian mounds of the Southern United States. The transfer also includes the A. H. Gottschall collection and the S. S. Haldeman collection, both of great scientific value. The Gottschall collection comprises thousands of Indian relics, such as costumes, pipes, weapons and stone work. The Haldeman collection is representative of the archeology and ethnology of the Indian and was brought together between 1840 and 1870. Mr. Charles M. B. Cadwalader, director of the academy, is reported to have said that the Moore collection "was going at the request of the donor."

A herbarium containing 40,000 specimens of plants, owned by Dr. Charles Atwood, of Moravia, who died recently, has been presented to Cornell University. The plants in the collection were obtained from all sections of the country, but the majority of the specimens are representative of plant life in central New York, particularly the Finger Lakes region.

DR. HUGH M. SMITH, who has been carrying on an investigation of the fish resources of Siam for the government of that country during the last several years, has been collecting natural history material in his spare time and sending the results of his labors to the U. S. National Museum, amounting now, in birds alone, to several thousand specimens.

H. V. COES, chairman of the finance committee of the American Society of Mechanical Engineers, has received from Ira N. Hollis, honorary member and past-president of the society and chairman of the committee on awards, a check for $1,000 for a "Bibliography of the History of Engineering" and for books not already in the library of the United Engineering Society in New York.

IT is announced that the first congress of the International Society for Microbiology, which was to take place in Paris in October, 1929, has been definitely postponed to June, 1930.

UNIVERSITY AND EDUCATIONAL NOTES

ISIDORE D. MORRISON, a lawyer of New York City, who has been active in the Zionist movement for more than thirty years, has contributed $100,000, together with a pledge of $10,000 annually for maintenance, for the establishment of an ophthalmic institute in connection with the Hebrew University in Jerusalem.

DR. ALAN R. ANDERSON, of the Mayo Clinic, Rochester, Minnesota, has taken office as dean of the New York Post-Graduate Medical School to succeed Dr. William D. Cutter, who resigned last July. Dr. Cutter becomes dean of the newly organized medical school of the University of Southern California.

PROFESSOR GEORGE P. BACON, for ten years head of the department of physics at Tufts College, has been appointed dean of the Engineering School.

AT Columbia University the following promotions to full professorships have been made: Sam F. Trelease, botany; Harold W. Webb, physics, and J. Enrique Zanetti, chemistry. Promotions to the rank of associate professor include: Earl T. Engle and Bern B. Gallaudet, anatomy; Frederick B. Flinn, physiology in industrial hygiene; Louis P. Hammett, chemistry; John E. Orchard, economic geography; Willard L. Severinghaus, physics, and T. Clinton Taylor, chemistry.

DR. JAMES PIERPONT, professor of mathematics at Yale University, will be a member of the coming University of California Summer Session at Berkeley.

DR. JOSEPH L. GILLSON, associate professor in the department of geology of the Massachusetts Institute of Technology, has been granted a leave of absence for the year 1929–30, and will serve as associate professor of economic geology at Northwestern University.

DANIEL FRANKLIN HIGGINS, a graduate of Northwestern University and for the present semester lecturer in petroleum geology at that institution, has accepted the professorship of geology at Lincoln Memorial University, Harrogate, Tennessee, for the year 1929–30.

DR. DIETER THOMA, head of the division of hydraulics at the Technical School at Munich, will be visiting lecturer at the Massachusetts Institute of Technology next October.

DR. E. L. BRUCE, professor of mineralogy at Queen's University since 1920, has been appointed first Miller Memorial Professor of Research Geology at Queen's University. The new chair has been founded by friends and students of the late Dr. Miller and by mining companies in Northern Canada.

DISCUSSION

THE FALL ZONE PENEPLANE

WITH the passing of years the subject of the peneplanes of the eastern United States has not gained in simplicity, and some may feel that the addition of another name to those already proposed for such features will needlessly complicate the existing confusion. Nevertheless, the erosional surface to which it is proposed to apply the term Fall Zone peneplane is of considerable importance to the geomorphologic history of the region between Connecticut and Georgia, although it has lacked proper recognition, perhaps on account of the absence of a convenient and suitable means of designation. In the following paragraphs the author sets forth his reasons for adopting the term "Fall Zone peneplane" in the hope that others may find the name useful.

The recognition that the erosional surface underlying the Coastal Plain deposits is entirely distinct in origin from the upland peneplanes of New England and the Piedmont has been a matter of slow development, which need not be discussed here. A number of years ago Shaw[1] reviewed the literature and emphasized the relationships for the region southwest of the Hudson; more recently Renner[2] has carried the discussion into southern New England. He recognizes the presence of two peneplanes where Davis and earlier writers had found only one: an older steeply sloping surface exposed by the stripping

[1] E. W. Shaw, "Ages of Peneplanes of the Appalachian Province," *Bull. G. S. A.*, 29: 575–586, 1913.

[2] G. T. Renner, "The Physiographic Interpretation of the Fall Line," *Geog. Review*, 17: 278–286, 1927.

away of the Coastal Plain to which he has tentatively applied the term Jurassic (?) peneplane, and the younger more gently sloping Upland peneplane to which he refers as the Tertiary (?). In his enlightening paper he assigns the origin of the falls and rapids of the Fall Line to the change in slope at the intersection of the two peneplanes.

Geologists in general have been slow to recognize this change in status of the Upland peneplanes, and they still are probably most commonly called the Cretaceous or Cretaceous (?) peneplanes, although as shown above it has become evident that the Coastal Plain basement and its uncovered extension is a distinct peneplane and not as formerly supposed the continuation of the Upland surfaces. Although of considerable extent and geologic importance this resurrected peneplane has had no more significant name than the Jurassic (?). In an unpublished report prepared in connection with a course in physiography at Columbia University, the writer, doubting the utility of age names of little accuracy and impressed by Renner's explanation of the origin of the Fall Line, first called this peneplane the Fall Line peneplane. Inasmuch as a peneplane is a surface the word line seemed misapplied, and at the suggestion of Professor Douglas Johnson the term Fall Zone peneplane was finally decided to be somewhat more appropriate. In fact, the peneplane stretches from Connecticut to Georgia in a long narrow belt or zone seldom fifteen miles wide between the more gently sloping Upland peneplanes on the west and the Coastal Plain on the east. It is considerably steeper than the Upland surfaces and perhaps averages fifty feet per mile in slope. Not only does the term Fall Zone avoid the implication of exact knowledge concerning the age of the peneplane, but it possesses the singular advantage of conveying a considerable amount of information about its location and significance in two words. For these and the following reasons the name is offered in the hope that its use may help to lessen the confusion surrounding the subject of the peneplanes of the eastern United States.

Although the Fall Zone surface has been called the Jurassic (?) peneplane, a moment's thought will show that this surface has the very structural relationship to the Cretaceous cover which the so-called Cretaceous peneplane, the Upland, was believed to have and which was the basis for dating the latter as Cretaceous. On correct evidence the resurrected peneplane, which it is proposed to call the Fall Zone, therefore has a better claim to the term Cretaceous than the Upland peneplane of New England or any surface correlated with the latter, although these have long been called Cretaceous because of a misconception. Nevertheless any belated attempt to rectify the error by calling the Fall Zone peneplane the "Cretaceous peneplane" would surely add to the difficulty, since with the general though unjustifiable use of the term Cretaceous or even Cretaceous (?) for the Upland surface, its application to the Fall Zone peneplane would simply add a second Cretaceous peneplane to geologic literature.

In addition it may be doubted whether the Fall Zone peneplane could properly be called Cretaceous, even though there were no other surfaces of that name. It is surely younger than the Newark Series of the Upper Triassic, for it is known to bevel rocks of that age in Connecticut and New Jersey. If, as some believe, the top of the Newark is of Lower Jurassic age, its development started later than early Jurassic. The tectonic disturbances which resulted in the block faulting of the eastern Triassic areas are usually dated at the end of that period or during the early Jurassic, and the Fall Zone surface was developed after these movements. On the other hand, a progressive overlap toward the northeast covered it with successively younger beds of Comanchian and Cretaceous age, and at any given area it must be older than the oldest of these beds immediately above it, so that it varies in time of completion from place to place.

As suggested by the overlap, one part of the peneplane was being buried while another part further north was apparently being carried to a greater stage of completion by erosion. In places where covered by the Lower Comanchian its formation must have taken place entirely within the Jurassic, and it might there be called the Jurassic peneplane. Elsewhere the time of its formation included not only most of the Jurassic but all the Comanchian up to the base of the Cretaceous or higher. These parts might perhaps be called the Jura-Comanchian or the Jura-Cretaceous peneplane, but it is evident that these terms no more than the Jurassic can be applied to the surface as a whole. Different parts of the same erosional surface are materially different in age, and the term Fall Zone may be taken to indicate a surface unit although not the same time of formation for that unit. An analogous case is found in stratigraphy where a formation name may indicate a stratigraphic but not a chronologic unit.

For the several reasons stated it seems desirable to avoid implying a single precise date of origin for a peneplane of wide extent. In the case of the surface under discussion such an implication is conveniently and suitably avoided by calling it the Fall Zone peneplane.

HENRY S. SHARP

COLUMBIA UNIVERSITY

MORTENSEN'S CIDAROIDEA

THE great work by Dr. Mortensen, "A Monograph of the Echinoidea, I. Cidaroidea" (Copenhagen, London, 1928), is mainly systematic, and, as this is his special interest, it is doubtless a very valuable contribution to our knowledge of the group. While the morphological portion is a subordinate part of the work, it is reasonable to expect that it should be treated with the care and correctness worthy of the subject and of such a monumental publication. There are, however, certain points that are open to criticism.

Dr. Mortensen thinks (p. 6), as set forth in his paper "Bothriocidaris and the Origin of the Echinoids" (Vid. Med. Dansk Naturh. Foren., Bd. 86, 1928), that Bothriocidaris can not be considered an Echinoid. His view is based largely on the radial position of the "teeth" and the madreporite in that genus. He, however, claims, as I believe is correct, that the supposed "teeth" are not teeth but plates. This being Dr. Mortensen's opinion, it is a peculiar argument that the radial position of parts (teeth) that he himself says are not present should be considered evidence against the Echinoid nature of Bothriocidaris. Madreporic pores, while typically interradial (in genital 2), often extend to radial (ocular) plates in recent Echini.

The characters of the Aristotle's lantern, with associated parts, in Echini, are of much interest and important for their bearing on classification. A correct understanding of these parts is essential to a student of the group. Dr. Mortensen says (p. 35): "The apophyses to which the lantern muscles are attached are interradial, while in all other Echinoids they are radial in position." This is not correct. In the Perischoechinoida no perignathic girdle was developed, as far as known. The evidence, based on young Goniocidaris (Lovén, "Echinologica," 1892), is that in Paleozoic forms the compass, protractor and retractor muscles were inserted interradially directly on the basicoronal interambulacral plates. In the Cidaroida apophyses are developed as outgrowths of the basicoronal interambulacral plates and on them, interradially, are inserted the compass, protractor and retractor muscles. In the Centrechinoida apophyses (interradial) are more or less developed, and on them are inserted the compass and protractor muscles, as in the Cidaroida. In the Centrechinoida, however, the new feature of auricles is introduced, as two plates joined by suture with the basicoronal ambulacral plates. On these auricles (radially) the retractor muscles are inserted. In the Clypeastrina the apophyses have disappeared, auricles alone are retained, and there are other changes that need not be considered here. This all is recorded by Lovén, 1892, or myself (Boston Soc. Nat. Hist., 1912, pp. 177–198). Lovén, in his study, first put the knowledge of the structure of the lantern and associated parts of Cidarids and other Echini on a firm foundation. Yet his work is not even mentioned by Dr. Mortensen.

Dr. Mortensen suggests (p. 35) that small "apophyses" on the interior of ambulacral plates of Cidarids may be considered the morphological equivalent of auricles in other Echinoids. It is unfortunate that he should use the term "apophyses" in two quite different senses. The spinose processes to which he refers are direct outgrowths of the ambulacral plates in Cidarids, have no sutures and extend well up in the interior of the test. On the other hand, auricles are separate parts joined by suture with the basicoronal ambulacral plates only. Auricles are unknown in the Cidaroida and first appear in the Centrechinoida. Dr. Mortensen, in his somewhat earlier paper on Bothriocidaris, suggested that these same ambulacral processes in the Cidaroida might be homologized with the ambulacral plates of starfishes.

In Dr. Mortensen's consideration of postembryonal development of Cidarids (pp. 39–40), he records his own work, also that of Döderlein and Grieg. He quite overlooks the work of Lovén (1892) on Goniocidaris, which is the most comprehensive and far-reaching work on the later development of Cidarids that has yet been published.

ROBERT TRACY JACKSON
MUSEUM OF COMPARATIVE ZOOLOGY,
CAMBRIDGE, MASS.

COSMOS UNLIMITED

IN an article: "The Creation of Matter," in SCIENCE for April 5, Dr. Walter S. Adams is quoted as asking, "Is it possible that radiation is finally reflected back from the boundaries of a limited space?" It would seem as if for the moment Dr. Adams's mind had lapsed from Einsteinian to Euclidean geometry, for, according to relativity, space, though limited in extent, has no boundaries.

The assumption that only a small part of the radiation of the stars can be absorbed by the nebulae is based on this idea of a restricted universe. If we conceive space to be infinite and everywhere peopled, as our great telescopes begin to show that it is, with systems of stars, which doubtless contain like our own vast tracts of nebulae both bright and dark, then all radiated energy must eventually be gathered up and set to work again on the unending round of evolution. How dark nebulae may originate in the dissolution of bodies that have sunk to the zero of temperature,

I have already suggested in an article entitled, "A Continuing Universe," published in *Popular Astronomy,* Vol. XXXVI, No. 6.

As Dr. Moulton well remarks, many minds seem to have a horror of an unending past or future, or of infinite space; yet in these very conceptions surely we have the most promising solution of the riddle of the universe. Though we can not understand all the processes, we may rest assured that Nature is not growing old, but is ever rising from the ashes of its past to renew its youth in immortal vigor.

J. G. PORTER

CINCINNATI OBSERVATORY,
APRIL 10, 1929

CHEMICAL TRAINING

THE sketch of the distinguished career of Thomas Burr Osborne (SCIENCE, April 18) recalls an incident of his early manhood, when he had just received his appointment as assistant in analytical chemistry at Yale but had not yet reached his doctorate. The quality of thoroughness, the "do-it-right" attitude, the meticulous care with which he carried on his experimentation, his intellectual integrity all showed themselves in 1883 when in a discussion carried on by a group of young people at a summer resort he exclaimed, "Training in a chemical laboratory does more to develop sound ethics than Sunday School lessons can ever do." One can not help asking whether present-day instructors are insisting that strict integrity more surely leads to success than cleverness in "getting by" does. That is one heritage from Thomas Burr Osborne.

MARION TALBOT

UNIVERSITY OF CHICAGO

SPECIAL CORRESPONDENCE

OPPORTUNITIES FOR RESEARCH OFFERED AT THE BIOLOGICAL LABORATORIES OF THE BUREAU OF FISHERIES

THE fisheries biological laboratories of the United States Bureau of Fisheries at Woods Hole, Mass., Beaufort, N. C., and Fairport, Iowa, will reopen for the summer's activities on June 17.

In accordance with the long-established policy of the bureau, facilities for research will be afforded at the various stations to independent investigators in addition to the bureau's regular staff. But the opening of the stations this year is especially worthy of being called to the attention of the scientific public, for extensive improvements and alterations in buildings, grounds and equipment completed during the last two seasons make these facilities more attractive than ever before.

The advantages of the stimulating surroundings at Woods Hole, where association with the great Marine Biological Laboratory and use of its library may be had, need not be stressed here. The fisheries laboratory, however, in addition to the usual advantages of any well-situated marine biological station, such as convenient supply of marine animals and plants, the common laboratory equipment and running sea-water, offers unusual opportunities for combining experimental work in the laboratory with field observations on ocean ecology. Such problems, for example, as studies of the factors controlling migration of the animal plankton, the richness of chemical foodstuff in sea-water compared with fluctuating abundance of the phytoplankton, and an almost unlimited number of problems of the same general type involving experimental work on the one hand and field work at sea on the other, might be cited as opportunities peculiar to this station. In addition to newly finished oceanographic and physiological workrooms and chemical storerooms at the laboratory, the service of such floating equipment as the bureau's sea-going steamer *Albatross II* and steamer *Phalarope,* which base at Woods Hole during part of the year, two smaller launches and several rowboats may be obtained. Furthermore, the chance to participate in a "going" program of fishery biology, such as studies that the bureau is now making on the bionomics of marine fisheries of the North Atlantic region, should prove attractive.

Owing to the increased demand for these accommodations, it has become necessary to make careful selection of those who are granted the privileges of the laboratory. Applications made well in advance are reviewed by a committee, and preference is given to those investigators who work along lines of especial interest to the bureau and who have shown ability for energetic and productive research.

Less well known to the younger generation is the fisheries biological laboratory at Beaufort, N. C. Since before the Civil War, the comfortable little city of Beaufort has been a favored resort for biologists, and the present biological station, opened for research in 1902, has been occupied almost continuously during the summer season in exploration and research. The station is situated on Pivers Island about 150 yards from the mainland in Beaufort Harbor and consists of a two-story frame laboratory building, 70 feet long and 42 feet wide, with two-story wings each 52 feet long, surrounded by porches. There are also adjacent to the main building a mess hall, power house, carpenter shop, boat house and terrapin-rearing house, and along the shores are constructed 15 large concrete enclosures for the rearing of terrapin. During the past year all of these build-

ings have been thoroughly renovated and additional equipment installed. The salt-water and fresh-water supplies have been modernized, the electrical system renewed and hot and cold running water provided for the dormitory rooms, which occupy the wings of the building. Compressed air and artificial gas are now supplied to the laboratories. An equally important improvement has been the installation of a central steam-heating plant, which makes the whole laboratory building comfortable for occupancy throughout the entire year. At the present time a residence for the director and his family is under construction.

The floating equipment of the laboratory has also been brought to a high standard of efficiency during the past year. A comfortable, sea-going motor cruiser and a smaller speed boat have been placed in commission and two other launches attached to the station have been rebuilt. The larger vessel is equipped with a laboratory, hoisting gear, nets, dredges and the usual oceanographic apparatus. About a dozen rowboats are provided for the use of the investigators. Dr. Henry Van Peters Wilson, veteran zoologist of North Carolina and a regular visitor at the Beaufort station, describes the laboratory as follows:

> The station has at its door the open ocean and fine sea beaches. Within what may be called the harbor, which is large and beautiful, passing east and west into sounds, are sand shoals, mud flats, and salt marshes. The tide brings in an excellent plankton. The whole fauna is varied and abundant, and, what is of the first importance, easily accessible to the individual collector. Moreover, through the work of biologists during the past fifty years it is sufficiently known to be usable for many sorts of investigations. The association of Beaufort with the general growth of American biology, as may be seen from the long list of published investigations carried on here, is interesting and stimulating. The laboratory is unusually comfortable and convenient . . . the summer climate is healthy and pleasant and the temperature and purity of the harbor water make collecting a pleasure. Beaufort is now easily reached by rail and hard-surface highway.

The fisheries biological laboratory at Fairport, Iowa, was established in 1910 as a center for research in fresh-water biology and aquiculture. Situated on a 60-acre plot of land with a ⅔-mile frontage on the Mississippi River, 8 miles north of Muscatine, Iowa, the station serves as a base for operations for a large part of the scientific work of the Bureau of Fisheries in the Mississippi Basin. The station has a number of buildings. The main laboratory, constructed of concrete, stone and brick, with ground dimensions approximately 100 by 55 feet, was erected in 1920 following the destruction by fire of the original frame building. This building, which has a fully finished basement, two full stories and a finished third story over the center and larger portion of the building, affords accommodation for 16 investigators and includes a well-lighted library, chemical laboratory, store room, museum, tank and aquarium rooms, and, in addition, dormitory rooms for men and women investigators. Several small cottages for families are provided near-by. On its property there are over 30 ponds, mostly earthen, varying from 1/10 of an acre to over 3½ acres in area. Water is supplied in abundance from two systems—the natural river water, which is pumped into a large storage reservoir and flows thence by gravity to the several ponds, and filtered river water, which is stored in low and high pressure cisterns for domestic and laboratory use. The buildings are lighted by electricity.

The large artificial ponds, the holding basins and the tank-house, all supplied with running river water, offer ample space with a variety of controllable conditions for experimental animals under observation. In a word, all reasonable needs for research in fresh-water biology are met.

The outstanding advantages of the Fairport station for work in fresh-water biology, however, come from the richness of the available fauna. In the Mississippi itself are representatives of all the living groups of ganoid fishes and many species of bony fishes as well, an interesting plankton and a considerable number of the larger invertebrates, among which the pearly mussels, the pulmonate mollusca and the May-flies are represented by many species. The ponds on the reservation and the sloughs and backwaters of the river offer several series of habitats, which during the summer months teem with the smaller invertebrates and plankton, including the fresh-water bryozoan Pectinella and many species of insects. These complexes are attractive for ecological and life-history studies. The fishes and amphibians of the region present an inviting field for the parasitologist, particularly as the ponds on the reservation are adapted to the following of host-cycle investigations.

A primary activity as a bureau station is the propagation of pearly fresh-water mussels, but no less significant are its functions in experimental fish culture as a branch of the expanding field of aquiculture and in the promoting both of a fuller utilization of water products and a broader interest in the protection of aquatic resources. Dr. Winterton C. Curtis, whose work, largely conducted at this station years ago with Doctor Lefevre on the mussels of the Mississippi River System, qualifies him to speak with authority, states:

"The station is better equipped for studies in fresh-water biology than any similar establishment in the

United States and perhaps in the world. It has the further advantage of not being owned by a local institution, as is the case with the summer stations of universities of this part of the country. There is every reason why it should become the most important center of summer biological work in the Mississippi Valley."

At all three of the bureau's stations, laboratory privileges, including either a private laboratory or a research table, the use of aquaria, glassware, the simpler laboratory apparatus and chemicals or reagents in moderate quantities, as well as dormitory space in the residence quarters, are provided to qualified independent investigators without charge. The Woods Hole laboratory will be open to private investigators from June 17 to September 14, but both the Beaufort and Fairport laboratories will be open for research in the future throughout the entire year. At Woods Hole the privileges of the Marine Biological Laboratory mess are accorded to the workers at the fisheries laboratory, while at the other two laboratories a cooperative mess is in operation during the summer season. The government provides fuel and labor for the preparation of meals, and the cost of the food is divided proportionately among the investigators. Applications for research privileges in these laboratories may be made direct to the Commissioner of Fisheries, Washington, D. C.

HENRY O'MALLEY,
Commissioner

WASHINGTON, D. C.

SCIENTIFIC BOOKS

Hydraulic Laboratory Practice, edited by JOHN R. FREEMAN, consulting hydraulic engineer. Published by the American Society of Mechanical Engineers, 1929. Cloth 9 x 12 in., pp. xxi + 868. 996 illustrations. $10.00.

THE flow of water, even in the simplest case, is a very complex phenomenon, and consequently the laws derived from theoretical hydrodynamics furnish only to a very limited extent a means of solving the hydraulic problems arising in practice, because the conditions must be highly idealized if the problem is to be amenable to mathematical treatment. Hence hydrodynamics has been called upon to furnish formulas which apply approximately to general types of problems, these formulas containing coefficients whose values can not be determined theoretically but can be found from experiment for a given set of conditions. Hydraulic engineers have used such laws in the design of hydraulic structures ever since hydraulics first merited the name of a science. However, in hydraulic design it frequently happens that the conditions to which a given formula apply differ so widely from those for which numerical values of the coefficients in the formula have been determined experimentally that the selection of the proper values for these coefficients is nothing more than an intelligent guess.

A more powerful method of solving complicated hydraulic problems, that of conducting model tests on a small-scale copy of the full-scale structure, was first utilized in a scientific way about sixty years ago, when William Froude applied this method in his epoch-making advance in the science of ship resistance. This was followed in 1875 by tests of a model of the Garonne River by Fargue in France and about ten years later by tests of a model tidal estuary by Osborne-Reynolds. In order that the results from such model tests may be used scientifically to predict the characteristics of the full-scale structure it is necessary that all parts of the model structure and the processes taking place in it shall be dynamically similar to the corresponding parts of the prototype in nature.

The nucleus of the theoretical foundation of dynamical similarity exists in Newton's "Principia" (1687) and was utilized in physics by Savart (1825) and by Cauchy (1829). In 1847 Bertrand clothed Newton's definition of dynamical similarity in mathematical language and derived the fundamental relation between the ratios of corresponding lengths, times, masses and forces in the natural structure and in the model. The theoretical foundation for model experiments was thus laid. The theory has been developed still further in Germany, England and the United States from somewhat different points of view, the Germans proceeding from a consideration of the differential equations of motion or from the dimensional forms of the forces involved, while the English and Americans have used the methods of dimensional analysis.

With the opening of the twentieth century, model experimentation in connection with fluid flow increased by leaps and bounds. The applications to aerodynamics are too well known to require comment here. But only since about 1926 has it become generally known in this country that a corresponding development has been going on in Europe in connection with hydraulic problems under the leadership of Engels, of Dresden; Möller, of Braunschweig; Rehbock, of Karlsruhe; Krey, of Berlin; Thoma, of Munich, and others.

In 1926 appeared the German edition of the book "Die Wasserbaulaboratorien Europas" sponsored by the eminent American hydraulic engineer, John R. Freeman, who brought about its publication in his

desire to make known to the engineers of the United States the progress in hydraulic science in Europe which he had observed during his travels abroad. This book contained descriptions of fourteen of the most prominent hydraulic laboratories of Europe, together with a description of the most important researches conducted in them, written by the directors of these laboratories. "Hydraulic Laboratory Practice," which appeared in January of this year and which Dr. Freeman sponsored and edited, is destined to have a profound influence upon the future of hydraulic science in the United States. The book is essentially a translation of "Die Wasserbaulaboratorien Europas," but has been enlarged by the description of the most recent research work conducted in the laboratories described in the German edition, by the description of many other European and several American hydraulic laboratories and by the inclusion of several chapters dealing with the theory of dynamical similarity as applied to hydraulic problems.

The laboratories described include river structures laboratories, pump and turbine laboratories and ship model research laboratories, of which the first class is treated most fully. The special apparatus developed for testing hydraulic structures in these laboratories is very interesting, particularly the glass-walled flumes in which studies are made of the flow over dam and weir sections, as well as scour at the foot of overfalls, the glass walls making it possible to watch the stream filaments and the scour in a way which can never be done in nature. The immense river flumes, shallow, but of wide extent, are capable of containing models of entire hydraulic projects. Models are also frequently built out-of-doors in order that the scale may not be too small when the structure in nature is extremely large. For example, in the out-door laboratory of the Experimental Institute at Berlin, a model of a fifty-mile stretch of the Havel and Elbe Rivers is being built to a scale of about 1:75, so that the model is approximately 3,600 feet long.

Of interest also to water-power engineers are the descriptions of equipment available in many European turbine laboratories for the study of cavitation. This is the foremost problem facing the hydraulic turbine designer to-day, yet there is not one laboratory in the United States equipped to study this phenomenon. Such a condition can not continue to exist if we are to keep abreast of foreign progress in this field. The attitude of several manufacturers of hydraulic turbines toward research is commendable, but the heads of other American concerns still can not see what part experimentation has in turbine design, although European design has been based upon experimental research for a long time.

Much space is given to the flow of water in open channels, a subject which was dealt with in a very unsatisfactory manner when the writer first studied hydraulics. Only during the last fifteen years has the existence of a third flow régime in open channels, that of "shooting" flow, been recognized generally, with many of its effects exactly the opposite of those involved in ordinary turbulent flow. The utilization in the United States of the hydraulic jump in a scientific way as a destroyer of the energy of water at the foot of an overfall dates only to the work of the Miami Conservancy Board, and as yet its possibilities are scarcely appreciated by most engineers, although its laws are now well established.

Another striking feature of "Hydraulic Laboratory Practice" is the evidence to be found throughout as to the great interest which is being shown in Europe in the study of the effect of flowing water on the form of stream beds. Not only are numerous fundamental researches being made continually in regard to this phenomenon, but the results of experiments are being applied in actual construction every day. In contrast to this activity abroad, we are practically standing still in the United States in the study of the formation of fluvial beds. Granted that this is probably the most difficult field of hydraulic research; granted also that the subject has hardly been scratched as yet; nevertheless, the possibilities are so tremendous and our river problems are so great that we should be bending every effort to acquire more scientific information, such as can be best obtained through laboratory experimentation combined with observations on our actual rivers.

It is impossible to undertake a discussion of the researches described in the book, for they cover all phases of hydraulics imaginable. Even the casual reader can not fail to be impressed with the evidence there given of the extent to which scientific methods have been applied in Europe during the past quarter century to the solution of the difficult problems arising in hydraulic engineering.[1]

HERBERT N. EATON

BUREAU OF STANDARDS

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN IMPROVED THERMOPILE VESSEL FOR THE ELECTROMETRIC DETERMINATION OF THE VOLUME FLOW OF BLOOD

IN an earlier paper Gesell and Bronk[1] described a continuous thermoelectric method of recording volume

[1] Publication approved by the director of the Bureau of Standards of the U. S. Department of Commerce.

[1] Gesell and Bronk, *Amer. Jour. Physiol.*, 1926, 79: 61.

flow of blood. The blood of a heparinized animal is allowed to flow from the proximal end of an artery through a glass tube about 15 cm long, returning to the circulation by way of the distal end of the same artery. This tube is surrounded by a water-jacket conducting water at a constant rate of flow. The water supplied at a constant temperature by a well-insulated Mariotte bottle is heated as it passes up the water-jacket in contact with the central tube. The water-jacket is in turn insulated against loss of heat to the exterior. By placing the cold junctions of a multiple thermopile in the course of the water inflow and the hot junctions in the course of the water outflow the degree of heating of the water which varies with the flow of blood can be followed. A continuous record of changes in blood flow in terms of E.M.F. is made on smoked paper by registering the movement of the drum of a Leeds and Northrup type K potentiometer required to keep the galvanometer at zero.

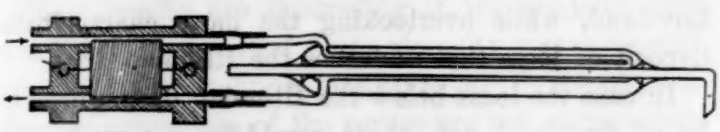

FIG. 1

The improvement of the thermopile vessel consists in substituting glass for bakelite. This construction eliminates several of the difficulties of the bakelite construction. Air bubbles in the water-line are visible and may thus be removed, and water leaks which were hard to avoid are eliminated. The outer insulating chamber is exhausted with the vacuum pump.

ROBERT GESELL

UNIVERSITY OF MICHIGAN

AN ENCLOSED DROP METHOD OF RECORDING VOLUME FLOW OF FLUIDS BY OIL DISPLACEMENT

THE method was devised primarily for following the volume flow of blood. The principle, however, may be applied for the registration of other flows as well.

The vein of a well-heparinized animal is prepared for insertion of two cannulas. The peripheral cannula is of the ordinary simple type. The central cannula is enlarged and shaped as shown in the figure. It is filled about half and half with isotonic salt solution and liquid paraffin and stoppered to the exclusion of air. The blood from the peripheral cannula is conducted into the central cannula through a glass tube which protrudes into the oil. As the blood flows it collects on the end of this tube in a large drop suspended in the supernatant oil displacing the salt solution below. The drop eventually falls and mixes with the saline and is in turn displaced into the circulation.

The flow may be recorded manually by signal or automatically by electrolytic contact as the drop falls between two sharply pointed electrodes. For electrical registration we have used a 2000-ohm telegraph relay (supplied by the J. H. Bunnell Company, 32 Park Place, New York) operating an ordinary signal magnet. Other simple methods of automatic registration may be used.

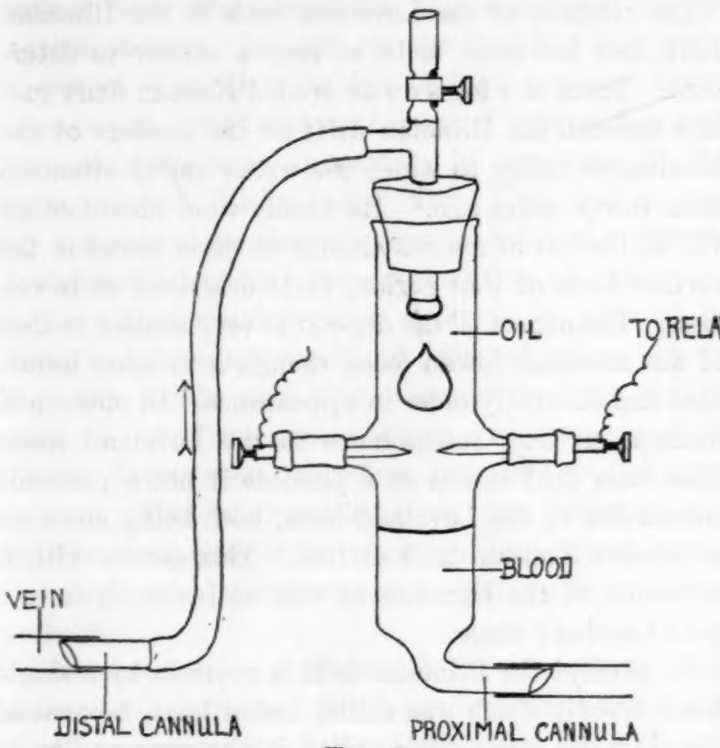

FIG. 1

The enclosed drop method of studying the flow of blood has the advantage of avoiding loss of blood and of automatically returning the blood to the circulation. Due to the buoying force of oil the drops are very large. It is thus possible to apply the drop method to relatively rapid flows.

ROBERT GESELL

UNIVERSITY OF MICHIGAN

SPECIAL ARTICLES

LOVELAND LOESS: PRE-ILLINOIAN, PRE-IOWAN IN AGE[1]

THE interpretation presented by Professor G. F. Kay in the November 16, 1928, issue of SCIENCE, that the Loveland loess is post-Illinoian, seems to be based on rather slender and inconclusive evidence. This being the case, the deduction drawn, that the Iowan falls in a separate glacial stage from the Illinoian, should be taken as tentative rather than final.

The present writer agrees with Kay as opposed to Shimek that the Loveland formation is not a fluvioglacial deposit of Kansan age, but is of much later date, and laid down on the eroded surface of the Kan-

[1] Published by permission of the director, U. S. Geological Survey.

san drift. It also seems to be mainly a wind deposit, classifiable as loess. He has also visited with Kay exposures of loess on an eroded Kansan drift surface under the Iowan drift of northwestern Iowa, and with him regards this loess as a probable correlative or continuation of the Loveland loess. We are thus in agreement that the Loveland loess is probably pre-Iowan.

The relation of the Loveland loess to the Illinoian drift does not seem to be so easy a matter to determine. There is a loess on an eroded Kansan drift surface beneath the Illinoian drift on the borders of the Mississippi valley to which the writer called attention some thirty years ago.[2] Its fossils were identified by W. H. Dall as of species similar to those found in the surface loess of that region, there described as Iowan loess. The aspect of the deposit is very similar to that of the so-called Iowan loess, though it is more indurated and distinctly older in appearance. In outcrop it bears a striking resemblance to the Loveland loess. This loess thus stands as a possible if not a probable correlative of the Loveland loess, both being down on an eroded Kansan drift surface. This carries with it reference of the Illinoian as well as Iowan drift to a post-Loveland stage.

In general the Illinoian drift is overlain by a single loess deposit which was called Iowan loess, because at the time the name was applied it was supposed to be closely related to the Iowan drift. This loess overlies the Sangamon soil and Illinoian gumbotil, forming the weathered surface of the Illinoian drift. It is now generally held that this loess is an interglacial deposit, for the molluscan fossils in it are of temperate climate species similar to the mollusks inhabiting the region. Its stratigraphic position is between the Sangamon soil and the early Wisconsin drift. It appears to have antedated that drift by only a short period of weathering, to which the name Peorian has been applied. It still stands in the position originally assigned to it, and it is a question whether it should not still carry the name Iowan loess pending the settlement of the place of Iowan glaciation in the Pleistocene chronology. Attempt has been made by some writers to name this loess Peorian, though that name was given to the interval of weathering following its deposition.

Beneath the Iowan loess there are a few places in which silt deposits, which in places simulate loess, occur in close association with the Sangamon soil and Illinoian gumbotil. These deposits are generally not as homogeneous as loess and are probably only in part wind deposits. Kay refers to deposits of this sort at the Farm Creek section, east of Peoria, discussed by Leighton in the *Journal of Geology,* in 1926, and considers them the equivalent of the Loveland loess. The description given by Leighton will serve to show the variable character of this deposit within a space of 225 feet, the length of the exposure:[3]

> Loess-like silt; on east side brownish in upper 1-1½ feet, grading below into grayish-yellow 2-2½ feet, and again into brownish with carbon specks, 3-4 feet, the lower two feet showing slight trace of effervescence with acid; no effervescence in upper 5½ feet; no bedding or stratification. On west side this loess-like silt is bluish-gray with greenish cast below the old soil, the soil and about six inches of the greenish loess is leached; calcareous below, very compact, no bedding or stratification, scattered small pebbles in lower three feet; thickness same on both sides of cut, 7-8 feet.

It appears that Professor Kay, in his attempt to settle the question of the relative ages of the Illinoian and Iowan drifts, is using nondescript deposits of this sort on the Illinoian drift as representative of the Loveland, while overlooking the more characteristic deposit of loess that underlies the Illinoian drift.

In case the loess below the Illinoian drift proves to be of Loveland age, there would be a very slender basis for referring the Illinoian and Iowan drifts to distinct glacial stages.

FRANK LEVERETT

ANN ARBOR, MICHIGAN

[2] "The Illinois Glacial Lobe," U. S. Geol. Survey Mon. 38, pp. 114-115, 1899.

[3] *Journal of Geology,* 34: 169, 1926.

ON THE ROTATORY POWER OF SERUM

WE have shown recently[1] that the viscosity of normal serum presented an absolute minimum value at a temperature near 56° C. The existence of this minimum is of particular interest inasmuch as it occurs at a temperature which is known to be of great importance biologically. Assuming that the physicochemical change in the serum (modified dispersion, birth and growth of micellae, fixation of water molecules) which resulted in an increased viscosity as soon as the turning-point (56°-57°) was reached, had an underlying cause of purely chemical nature, we have tried to prove its existence by measuring the rotatory power of the serum at all temperatures up to 70° C. and after heating for various lengths of time. The purpose of this short paper is to summarize the results obtained.

(1) There is no temperature coefficient for the levo-rotatory power of the serum, up to 55° C., for rapid heating. Mean values are, for a tube 10 cm long (normal horse serum), $-4°.16$ (green line of the mercury arc); $-3°.61$ (yellow lines); $-2°.95$ (red line). The mean specific rotatory power being: $-58°$ (green line); $-49°$ (yellow line); $-40°$ (red line).

[1] *J. of Gen. Phys.,* 12: 363. 1929.

(2) One hour's heating at 50° only produces a very slight change in α. After 55°, an increase in the rotatory power is observed and the rate of the increase becomes considerable as soon as 60° are reached. The increase is always much more rapid in the first minutes of heating. The slope of the curve representing the phenomenon is less marked as the time of heating increases. (Heating in sealed tubes.)

(3) When 10-cm tubes are used, the readings are no longer possible, on account of the darkening of the field, after an increase of, roughly, 0°80 in the angle of rotation is observed. This darkening occurs generally, whether the serum is heated for two hours at 58°, one hour at 59°, forty minutes at 60°, twenty minutes at 61°, five minutes at 64° or two minutes at 68°. It limits the readings, so that no greater increase in the angle of rotation was observed. However, these figures are not absolute, and refer to one kind of serum. Different sera may yield slightly different values.

These results are interesting if we compare them with the data obtained from viscosity measurements. From the latter we know that up to 50° C. the physicochemical properties of the serum are not permanently affected. The polarimeter shows that no chemical modification occurs up to that temperature. The slope of the viscosity curve as a function of temperature begins to change after 50°, and reaches a minimum between 56° and 58°. At the same temperature, the angle of rotation shows a marked increase. After 59°, the viscosity increases, and this increase becomes very rapid when 62° are reached. The same phenomenon characterizes the rotatory power.

We therefore believe that it may be concluded that the alteration in the structure of the protein molecules, the chemical phenomenon which is followed by means of the polarimeter, is the underlying cause of the physical perturbation in the colloidal equilibrium of the serum on the one hand, and of the biological perturbation—the "destruction of the complement"—on the other hand. The darkening of the solution, which does not influence the rotatory power, is probably the optical expression of the physical changes in the solution which affect the viscosity.

Institut Pasteur, Paris P. Lecomte du Noüy

INHERITANCE IN LETTUCE

In an investigation conducted at the Illinois Agricultural Experiment Station for five years, the author made crosses between representative varieties of heading, leaf and Cos types of cultivated lettuce. Crosses were also made between these and the lobed and unlobed forms of the wild *Lactuca scariola* L. found in central Illinois. Some crosses were grown to the fourth generation.

In making the crosses, Oliver's method of depollenation by means of a stream of water was employed. The investigation has shown that both cultivated lettuce and the wild forms of *L. scariola* are largely self-fertilized.

The Big Boston, May King and wild forms have anthocyanin pigment in their leaves and stems, while Grand Rapids and Paris White Cos have none. Five crosses were made involving pigmented and unpigmented parents. Inheritance was found to take place in simple Mendelian fashion in four crosses. Influences which interfered with normal segregation and recombination were apparently in operation in the cross unlobed Wild × Paris White Cos, and it was not determined conclusively how inheritance occurred. Anthocyanin pigment was dominant in all cases.

The plants which carried anthocyanin pigment in stems and leaves were found, without exception, to have ray florets with blue pigment on their undersurfaces. Anthocyanin in stems and leaves and in the ray florets were, therefore, inherited in the same manner. The two conditions are due either to one and the same gene or to two completely linked genes. The single-gene interpretation appears to be the more probable.

Six crosses were made which involved black- and white-seeded parents. Black seeds proved dominant in all crosses. Inheritance took place on a simple Mendelian basis, but in the cross May King × lobed Wild an influence was in operation which consistently caused a deficiency in the number of black-seeded plants in F_2.

Five crosses were made between the prickly wild forms and cultivated varieties. Inheritance of prickliness apparently took place on a simple Mendelian basis, but in four crosses the ratios deviated significantly in some families from the expected proportions. In the cross May King × Wild, the F_2 ratios deviated widely in 1915 but were approximately normal in 1916 and 1917. The prickly condition was dominant in all crosses.

In crosses of the unlobed Big Boston and May King varieties with the lobed wild *L. scariola,* two pairs of factors acting in a complementary manner were apparently involved. In a cross between the same lobed strain and an unlobed wild form, inheritance took place on a simple Mendelian basis. Lobed leaves were dominant in all three crosses.

Differences in leaf length, leaf width, width index, leaf area, time required to produce flowers, plant height and rosette habit were found to be inherited in a quantitative manner. The F_1 generations were found to be no more variable, as a rule, than the parental types. Increased variability and segregation were shown by the F_2 generations. Certain genes

of the wild forms were apparently more or less dominant to their respective allelomorphs of the cultivated varieties with respect to some characters. Skewed and multimodal effects were manifested by some frequency distributions. Paris White Cos was the only cultivated variety which gave evidence of having any quantitative characters dominant to those of the wild lettuce. F_3 and F_4 generations gave further evidence of segregation. In practically all crosses it was found possible to establish new types, of comparatively low variability, in F_3 and F_4, with higher or lower mean values, or both, than those of the parent varieties.

The wild forms of lettuce gave evidence of being more heterozygous for some quantitative characters than the cultivated varieties. This difference is believed to be due to the effect of artificial selection in promoting the development of fairly homozygous cultivated varieties, while in the wild forms there has been no restraint, other than that of natural selection, to the perpetuation of mutations which have probably occurred with respect to quantitative characters.

The investigation indicates that the growth of lettuce is highly susceptible to environmental influences. Cultivated varieties apparently possess genetic combinations which respond more favorably to moist weather conditions than those of the wild forms.

The results of this and other investigations indicate that in many cases modified and deviating Mendelian ratios may be the result of linkage of quantitative genes with genes affecting fertility or sterility which are highly responsive to variations in environment.

Castle's proposed method for estimating the number of pairs of genes involved in quantitative inheritance is not adapted for the purpose so far as lettuce is concerned, and it is believed to be inadequate in practically all cases of quantitative inheritance.

The results indicate that cultivated lettuce probably developed from the wild *Lactuca scariola*. The differences can be accounted for very largely, if not entirely, by the appearance of mutations in dominant genes, coupled with the cumulative effects of artificial selection in perpetuating modifications which have served the purposes of man.

The method of nomenclature originally proposed for cultivated lettuce by Linnaeus and recently revived by Bailey (1924) is supported by the results of this investigation.

This preliminary report is made in order that the more important results of the investigation may be placed on record. A more detailed account of the experiments will be published at a later date.

CHARLES E. DURST

WHEATON, ILLINOIS

THE NATIONAL ACADEMY OF SCIENCES. III

A Pleistocene avifauna from Florida (illustrated): A. WETMORE (introduced by David White).

Mountain building in Fenno-Scandia and pre-Cambrian correlation: J. J. SEDERHOLM (by invitation). In Fenno-Scandia several different epochs of mountain building can be distinguished. The mountain chains of different age intersect each other and show no parallelism in their strikes. Thus at the Arctic coast three mountain chains of different ages, directions and character occur near to each other. In the "Karelides" of eastern Finland, old mountain chains with a prevalent north-northwesterly strike, the intensity of the diastrophism varies greatly in different zones. In some areas the rocks are slightly disturbed and feebly metamorphic; in others they are strongly folded, highly metamorphic and intimately injected with granitic veins, thus presenting the character which is common in the Archean. The character of the disturbances has been, as lately shown by Wegmann, very similar to those which have taken place in the Alps. There have existed simultaneously more or less resistant areas, and the folding has not been uniform or ubiquitous. The author thinks that there is in general no certain evidence of a ubiquitous folding in pre-Cambrian time. Much of the correlation of pre-Cambrian series in different parts of the world has been based on that wrong presumption and must therefore be revised. Rocks which show a "Proterozoic" type in some parts of the world may be expected to be extremely crystalline and intimately injected by granite in another, and a correlation based on the relation of the sedimentary deposits to epochs of diastrophism will be possible only if we are able to show which are really synchronous. Analogies in the character of sediments, caused by climatological differences, world-wide epochs of volcanism, etc., may give further criteria to their correlation. Only by a detailed comparative study of pre-Cambrian rocks in different parts of the world will it be possible to work out their correlation and succession. In Fenno-Scandia alone, at least three or four great cycles of pre-Cambrian sedimentation exist, separated by periods of diastrophism and base leveling. The length of pre-Cambrian time, as measured by the sedimentary record, must be longer than that of all post-Cambrian time.

The rock suites of the Pacific and the Atlantic Ocean basins: HENRY S. WASHINGTON. At each of various regions of the earth the igneous rocks of a given region resemble each other (in mineral and chemical characters), so that one region may be very different from, or may be very like to, other regions, so far as its rocks go. Such regions of related rocks are called petrographic provinces. The petrographic provinces on the largest scale are the various continents and the floors of the various ocean basins. All the continents are made up for the most part of granitic rocks, while the ocean floors are composed largely of basalts, which are very different in many respects from granites. We can judge of the kind of material that forms the ocean floors by the lavas that

ave come up from below and that have formed the olcanic islands in the oceans. From many studies made n recent years we are sure that, while heavy basaltic ocks compose in great measure the floors of both the acific and Atlantic Oceans, yet there are all over in oth oceans small quantities of very different kinds of avas that contain much soda and potash, of which the asalts contain but little. Furthermore, the rocks of the acific and Atlantic islands, although they are much alike n general, show marked differences in some details, so hat they do not appear to belong to the same petrographic province. It is thought by many that these differences are connected with the different ways by which he borders of the two ocean basins have been formed. The Pacific basin is surrounded by long mountain chains hat have arisen by lateral pressure, while the borders of he Atlantic basin have been formed mostly by vertical inkings and risings of great blocks of the earth's crust. It is suggested here that the differences between the ocks of the continents and those of the ocean floors, as well as those between the floors of the various ocean basins, have been little influenced by such movements of he crust, but that they may differ because the upper part of the original molten globe was not uniform all over, but varied in composition over large areas, before he crust was formed.

Bioelectrical phenomena: W. J. V. OSTERHOUT. Waves of negativity, similar in magnitude and form to those observed in muscle and nerve, may be produced in *Nitella* by a variety of chemical and physical agents. They may also occur spontaneously and are often rhythmic in character.

Some significant properties of the virus of typical tobacco mosaic: B. M. DUGGAR. Temperature relations of the mosaic virus have been determined by a new method eliminating the usual lag in temperature effects. Determinations of the relation to acetone, alcohol and other chemical agents as well as to solutions of high concentration seem to denote an agency with a stability above that of the bacterial vegetative cell, but distinctly more sensitive than the typical spore of bacteria. Adsorption and oxidation studies confirm previous reports of the colloidal properties of the virus, while resistance to enzymic action is a property of special significance.

Chemical aspects of disease resistance in the onion: J. C. WALKER, K. P. LINK and H. R. ANGELL (introduced by L. R. Jones). Resistance in the onion to the smudge disease caused by the fungus *Colletotrichum circinans* (Berk.) Vogl. is closely associated with the occurrence of pigments in the bulb scales. This resistance is caused by one or more readily diffusible substances present only in the pigmented scales. Drops of liquid from the scales containing these diffusible substances are toxic to the fungus, preventing normal germination and growth of the spores and mycelium. Invasion by the fungus is therefore less common in the pigmented bulbs than in the white bulbs. The chemical study of the water soluble substances from the pigmented scales has shown that one of the toxic entities is the phenolic acid, commonly known as protocatechuic acid. This acid has been isolated in a pure crystalline condition from the pigmented scales by a procedure that firmly indicates that the acid exists in the free state (*Jour. Biol. Chemistry*, 81: 369. 1929). The purified protocatechuic acid in dilutions of 1 part to 3,000 parts of water exhibits the characteristic toxic effects on the fungus organism that had previously been ascribed to the crude water extracts attainable directly from the pigmented scales. Protocatechuic acid appears to be one of the chief constituents responsible for the marked resistance exhibited by the pigmented onion to the smudge disease. To our knowledge this is the first time that disease resistance in plants has been attributed to a definite chemical entity present in the resistant host (the pigmented onions) and absent in the non-resistant host (the white onions).

The Opalinidae and their significance: MAYNARD M. METCALF (introduced by Lorande L. Woodruff). The things emphasized in this paper are: (1) the intermediate character of the Opalinidae, especially in nuclear conditions, between the Flagellata and the Euciliata; (2) the broad significance of data from parasites, when studied in connection with their hosts, especially as to geographical distribution, and (3) the need of further study of a number of features in the Opalinidae.

The macronucleus of Uroleptus Halseyi: GARY N. CALKINS. The macronucleus of *U. Halseyi* arises as a product of the second division of the zygote nucleus after conjugation. The Feulgen nucleal reaction shows no chromatin at the outset. After twenty-four hours small granules appear in the matrix of plastin (?). These increase in size and become demonstrable by the Feulgen method. Ultimately they fill the nucleus as minute rods of chromatin which stain intensely with nuclear dyes. They originate and grow evidently by the slow accumulation of nucleic acid. The nucleus now divides repeatedly until the definitive number is formed. When four are thus formed, the cell divides, the remainder being formed by nuclear division after the daughter cells separate. Prior to the next division of the cell each macronucleus forms a nuclear cleft (Kernspalt). This results as an effect of the action of granules (x-granules) in the nucleus which collect at a certain zone near one end. These granules are not chromatin but apparently act as catalytic agents which cause one end of each nucleus to be cut off. This end and the x-granules are cast off into the cytoplasm where they disappear. The remainder of each nucleus fuses with its fellows to form again a single division nucleus as at the outset. During conjugation the macronuclei gradually fade away and disappear in the cytoplasm. In their final condition they are each resolved into an aggregate of minute vesicles. Densely staining cortical material collects or is precipitated on the surface of these vesicles. This cortical substance breaks up into minute rods or crescents which disappear upon treatment with ether, acids or ultra-violet rays, and which give characteristic reactions with osmic and the usual chondriosome methods. These granules are undoubtedly the same as those which have been generally described as the protozoan mitochondria.

Biographical memoir of Edward Drinker Cope: H. F. OSBORN.

Biographical memoir of Henry Andrews Bumstead: LEIGH PAGE.

Biographical memoir of Henry Larcon Abbot: C. G. ABBOT.

Biographical memoir of Sidney Irving Smith: WESLEY R. COE.

Biographical memoir of Addison Emery Verrill: WESLEY R. COE.

The rôle of research in the development of forestry in North America: I. W. BAILEY and H. A. SPOEHR (introduced by John C. Merriam).

The Manobos of Mindanao: JOHN M. GARVAN (introduced by Raymond Pearl).

Approximation and correction as a general behavior pattern: RAYMOND DODGE. An important contribution to the formulation of behavior patterns was made by Thorndike, Lloyd Morgan and Jennings in the concept of trial and error, or better, trial and selection. While the concept applied primarily to infra-human responses to new situations it has also been useful in the description of human behavior. If one includes thought adjustments many of our human reactions in the practical conduct of life, in the earlier stages of invention and in scientific exploration seem to follow a pattern that reaches well back in the phylogenetic series. There is some evidence that in slightly more advanced stages of adjustment development of reaction proceeds not by the selection of a more appropriate mode of reaction but by the correction of approximations within the same general mode. Records of human eye movements following an object in harmonic motion, fixating a peripheral object and fixating a foveal object lead to the following generalization: Approximation and correction is a type of adjustment that appears in relatively simple forms of human behavior. We conjecture that it ranks with trial and selection as a general formula of adjustment. While the beginning of response to new situations commonly follows the trial and selection pattern, subsequent adjustment within any selected mode of response commonly follows the pattern of approximation and correction. The latter seems to be a complement of the former.

Pyrogenetic decomposition of the acid amides: EDWARD C. FRANKLIN.

The structure of thymonucleic acid: P. A. LEVENE and E. S. LONDON. The plant nucleic acid is regarded as a tetranucleotide, each nucleotide being composed of phosphoric acid, a sugar (ribose) and a nitrogenous component. The evidence for this theory of structure is complete, inasmuch as it was possible to decompose the nucleic acid into the individual nucleotides, and each of the nucleotides into phosphoric acid and the complex consisting of the sugar and a base. For the thymonucleic acid an analogous structure was suggested. The evidence, however, was incomplete, since it was impossible to decompose by chemical means the thymonucleic acid in such a manner as to obtain the complexes consisting of the sugar and bases. Such complexes are known by the name "nucleosides." By means of intestinal juice, it was now possible to hydrolyze the thymonucleic acid in a way which made possible the isolation of the four nucleosides present in the molecule of the acid. The nucleosides then made it possible to isolate the sugar component of the thymonucleic acid. Contrary to expectation, the sugar is not a hexose but a desoxypentose.

Crystalline turanose: C. S. HUDSON and EUGEN PACSU. The trisaccharide melezitose can be hydrolyzed by weak acids to yield glucose and a disaccharide which was named turanose by its discoverer Alekhine. Turanose has in turn been hydrolyzed by G. Tanret, using stronger acids, to glucose and fructose. Turanose has never been obtained fully pure in the past because no one has succeeded in crystallizing it. In 1918 one of the authors (C. S. H.) found an abundant supply of the rare melezitose in a certain kind of honey and from it he prepared a small quantity of turanose in the hope of crystallizing it. Other samples of turanose sirup were prepared subsequently from this same stock of melezitose by other workers. Recently it was observed that one of these sirups, the exact history of which is not now known, had crystallized after standing for many years. By the use of these crystals to nucleate turanose sirups which we have lately prepared from melezitose it has been possible to obtain a rapid crystallization of turanose and the sugar has been recrystallized with ease from hot methyl alcohol in which it is moderately soluble. Crystalline turanose on solution in water shows a large and rapid mutarotation. At 20° the rotation of its freshly prepared aqueous solution three minutes after dissolving was approximately $[\alpha]^{20}_D = +43.5$ and the value became constant within twenty minutes at about $[\alpha]^{20}_D = +75.6$. Crystalline turanose is thus a beta form of the sugar. The crystals are well-formed prisms with many faces developed. The sugar possesses a sweet flavor. Its melting point is 157°. A study of this interesting disaccharide, which can now be obtained in pure condition, has been undertaken.

Transformation of lactose to a new disaccharide, lactoketose: EDNA MONTGOMERY and C. S. HUDSON. The authors have sought to use the Lobry de Bruyn interconversion of sugars in alkaline solution as a general preparative method for the production of new ketoses from aldoses. In weakly alkaline lime water lactose rapidly changes in part to a new sugar which has been isolated in pure crystalline condition and named lactoketose. Its hydrolysis by acids yields a mixture of galactose and fructose. Its osazone is identical with lactose osazone and hence the new sugar is a galactosidofructose disaccharide, a new ketose. As would be expected from its ketonic character, lactoketose is not oxidized by iodine in alkaline solution.